

**FOR IMMEDIATE RELEASE**

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**Average market value for 594 non-certified tech skills remained unchanged in the third quarter of 2020 despite 186 changing in value from the prior quarter. Average cash pay premiums rose overall for Applications Development Tools & Platforms, Data/Database, Operating Systems and Management, Methodology and Process skill groups.**

**516 tech certifications continued their more than two-year overall decline in quarterly average market value, with pay premium losses in all but Networking and Applications Developments/Programming Languages segments.**

**How has the COVID-19 pandemic impacted tech domains, jobs and pay, and what does the future look like for tech professionals?**

**NOTE:** This news release is a summary extract of content in the 4th Quarter 2020 update of Foote Partners' *Tech Skills Demand and Pay Trends Report* and *IT Skills and Certification Volatility Index*, two market intelligence trend reports updated every 3 months from data contributed by 3,640 U.S. and Canadian employers. It contains tech jobs and skills trends published in the firm's *IT Professional Salary Survey* and *IT Skills and Certifications Pay Index™* and deep-dive supply/demand benchmark and empirical research from Foote Partners field interviews.

Vero Beach, FL – October 31, 2020 - Extra pay awarded by employers to talented tech professionals for **594 non-certified tech skills** ---also known as cash pay premiums---remained unchanged on average in the third calendar quarter of 2020. Currently averaging **the equivalent of 9.6 percent of base salary on average for a single non-certified skill**, this is the highest average premium in 20 years. Conversely, average market values for **516 tech certifications** decreased from July to September, down 1.5 percent overall, currently earning the **equivalent of 6.8 percent of base salary on average for a single certification**. That's the lowest average pay premium for IT certifications in 7 years and **the widest gap between certified and noncertified tech skills pay since mid-2000s**.

This according to the latest quarterly update of Foote Partners' *IT Skills and Certifications Pay Index™* (ITSCPI) based on compensation data provided by 3,640 private and public-sector employers in 83 U.S. and Canadian cities who partner with the firm to report pay for their 330,340 technology professionals in the U.S. and Canada.

Since its launch in 1999, the *IT Skills and Certifications Pay Index™* has continuously tracked cash pay premiums paid to tech professionals by their employers for an ever-increasing number of popular tech skills and certifications. Rigorously validated data and detailed market analyses are updated and published by Foote Partners every 90 days. Currently, premiums are reported for 1,110 certifications and non-certified skills.

### Pay Performance, 3/12/24/24/36 months Certified vs. Non-certified Tech Skills

(81,032 IT professionals, data through 7/1/2020)

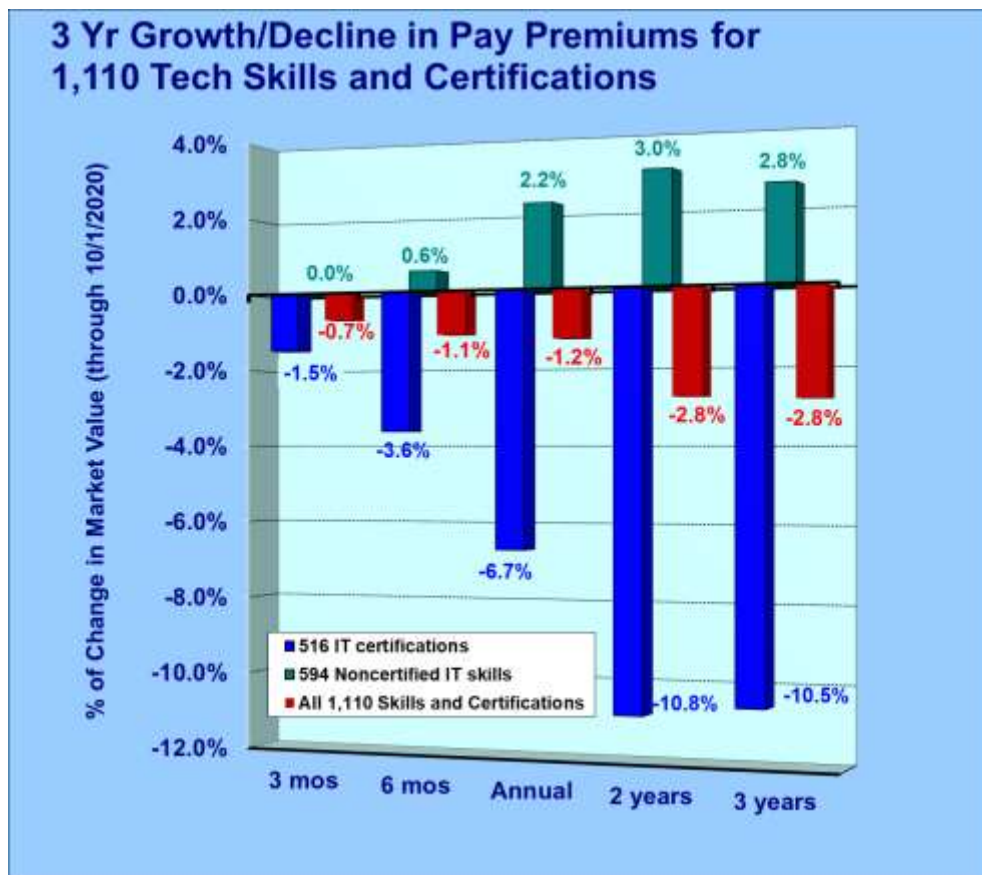
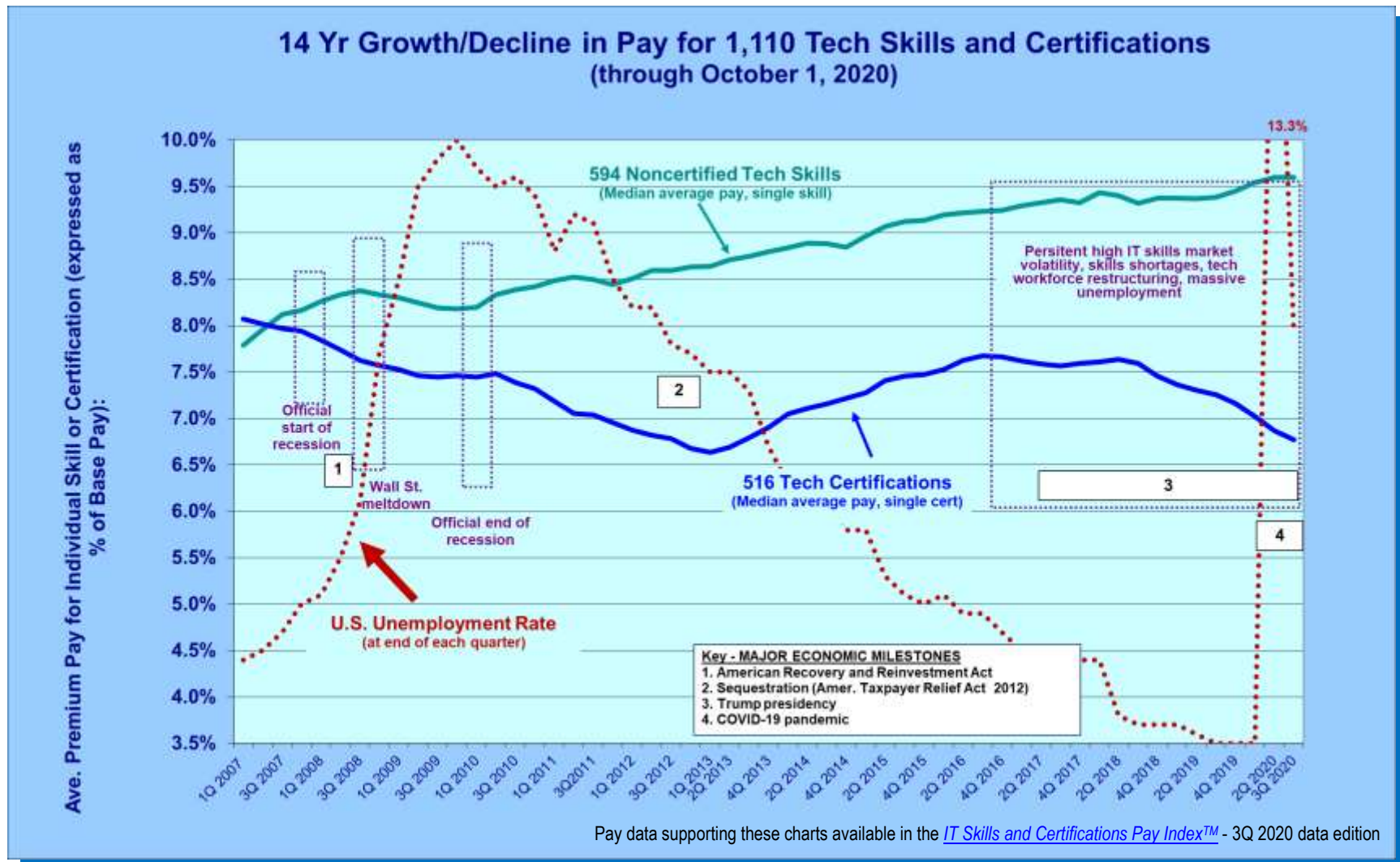


Figure 1

Source: Foote Partners, *IT Skills and Certifications Pay Index™* (3Q2017 – 3Q2020 datasets)

## 14-YEAR PAY PREMIUM TRENDS: Certified versus Noncertified Tech Skills

Average median cash pay premiums for a single certified or non-certified IT skill. 81,032 IT Professionals



IT NON-CERTIFIED SKILLS PAY SUMMARY – Through October 1, 2020

A. NON-CERTIFIED TECH SKILLS PAY PERFORMANCE: By Category

**NON-CERTIFIED TECH SKILLS.** 186 non-certified tech skills changed cash market value in the third quarter of 2020, with the average cash pay premiums for **594 non-certified skills** unchanged from the prior quarter. Pay performance from July to September was higher for four of eight non-certified tech skills categories reported. For the twelve-month period ending October 1st pay was also higher for five categories.

Noncertified Tech Skills - % Growth/Decline  
 3 months & 12 months

(594 skills, data through 10/1/2020)

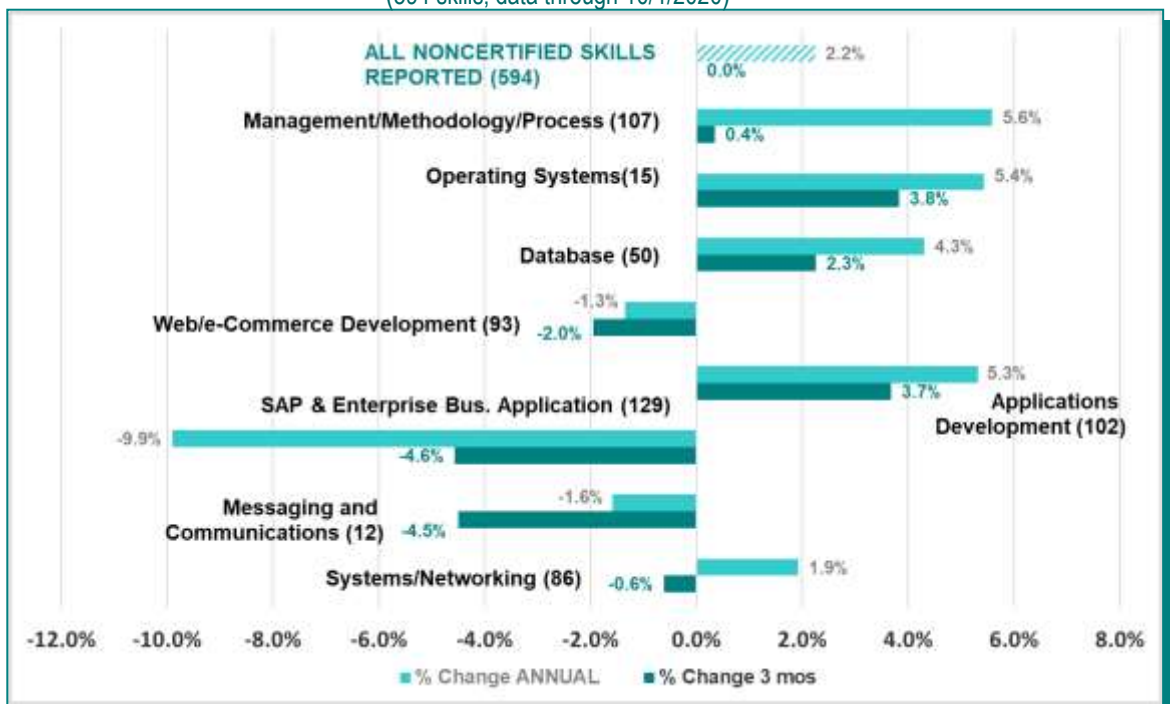
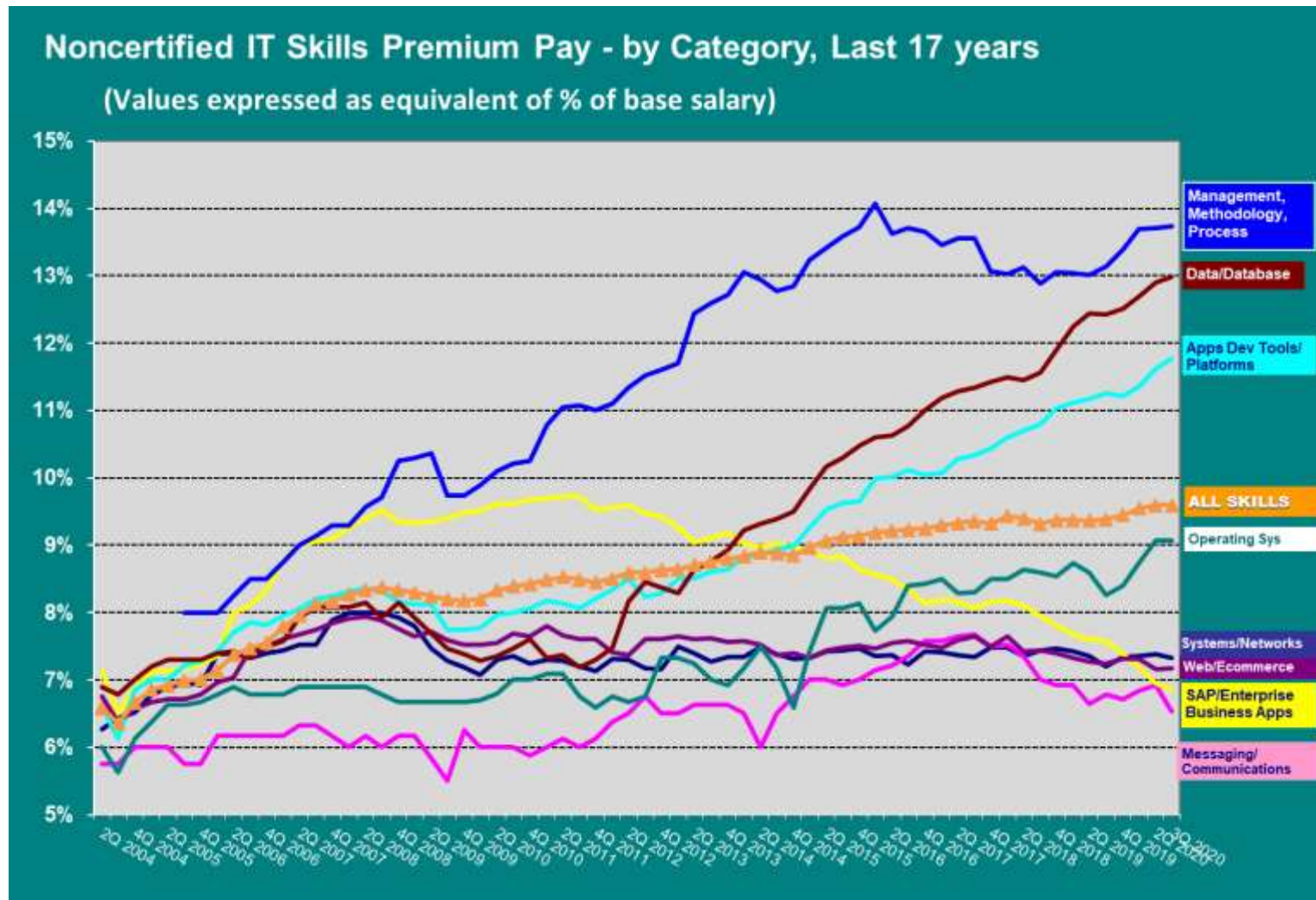


Figure 2

Source: Foote Partners [IT Skills & Certifications Pay Index™](#), 3rd Quarter 2020 data

## 17-YEAR NON-CERTIFIED TECH SKILLS PAY TRENDS BY CATEGORY

Average median cash pay premium for a single non-certified IT skill. Data through October 1, 2020 – 81,032 IT Professionals



Pay data supporting these charts available in the [IT Skills and Certifications Pay Index™](#) - 3Q 2020 data edition

## NON-CERTIFIED TECH SKILLS TREND HIGHLIGHTS: Market Value Gainers & Highest Paying – 3<sup>rd</sup> Quarter 2020

These noncertified tech skills **gained 10% or more in market value** in the three months ending October 1, 2020 vs. prior quarter (seen below grouped by segment). **Listed in descending order of amount of % gain and cash pay premium** (including ties). Highest paying skills listed on right in **alphabetical order**.

TECH SKILLS (noncertified)			Highest Paying – Cash Premiums (A-Z)
<p><b><u>Applications Development skills</u></b>                      SPSS                      Apache Zookeeper                      Apache Ant                      Red Hat Fuse                      Apache Lucene                      Ethereum                      Visual C++                      Apache Camel                      Tcl                      NUnit                      SQL                      C#</p>	<p><b><u>Systems/Networking skills</u></b>                      Rackspace Cloud                      VMware ESXi Server                      VoIP/IP telephony                      Cisco ASA                      WAN 4G/5G services                      Wireless sensors/RFID                      Cisco Nexus                      Tivoli                      Cisco UCCE                      Wireless security</p>	<p><b><u>SAP &amp; Enterprise Business Applications skills</u></b>                      SAP WEBI (BusinessObjects Web Intelligence)                      Pega                      SAP Hybris                      Oracle CRM                      J.D. Edwards (Oracle)                      Oracle Payables                      Remedy ITSM                      SAP BI (SAP BW)                      Oracle SCM (Supply Chain Management)                      Oracle BPM</p>	<ul style="list-style-type: none"> <li>- Amazon Athena</li> <li>- Apache Zookeeper</li> <li>- DevSecOps</li> <li>- Ethereum</li> <li>- Flink</li> <li>- HBase</li> <li>- Marketo</li> <li>- Master data management</li> <li>- Natural language processing</li> <li>- Neural Networks</li> <li>- Oracle Coherence</li> <li>- Risk analytics/assessment</li> <li>- RStudio</li> <li>- Security architecture and models</li> <li>- Smart Contract</li> </ul>
<p><b><u>Database Skills</u></b>                      Data mining                      OpenEdge ABL                      Database management                      Oracle Coherence                      Microsoft Exchange Server                      2003/2007/2010/2013                      HBase</p>	<p><b><u>Operating Systems skills</u></b>                      Mac OS X                      Windows 10                      Windows Server 2019/2016/2012                      Unix (all)</p>	<p><b><u>Web/SOA/E-Commerce skills</u></b>                      Front End Development                      Jetty                      Apache Velocity                      Ajax (Asynchronous JavaScript and XML)                      SOAP                      XML (all variants)                      Scalable Vector Graphics (SVG)                      JavaBeans/EJB 3.0                      Java Server Pages                      Microsoft Identity Integration Server (MIIS)                      JBoss /WildFly                      Oracle Workflow                      Pandas                      Spring Cloud</p>	
<p><b><u>Messaging/Communications skills</u></b>                      Oracle Communications Messaging Server                      ActiveMQ</p>	<p><b><u>Management, Process &amp; Methodology skills</u></b>                      Data Privacy                      Keras                      Data Acquisition and Control Systems                      HL7                      Data Security                      Marketo                      Flink</p>		
<p>Source: Foote Partners <a href="#">IT Skills &amp; Certifications Pay Index™</a>, 3rd Quarter 2020 data edition</p>			

**NON-CERTIFIED IT SKILLS TREND HIGHLIGHTS: Market Value Losers – 3<sup>rd</sup> Quarter 2020**

These noncertified IT skills **declined 10% or more in market value in the three months ending October 1, 2020** (grouped by segment).  
**Listed in descending order of amount of % decline**, including ties.

<b>TECH SKILLS (Noncertified)</b>			
<p><b><u>Applications Development skills</u></b> BusinessObjects Progress 4GL/Development A796tools Cognos JBehave Apache Airflow Epic Systems applications</p> <p><b><u>Web/E-commerce Development skills</u></b> Backbone.js Joomla! Google App Engine Magnolia Active Server Pages Google Analytics Ember.js WebSphere Datapower Spring MVC Umbraco JSON Apex Code Mule/MuleESB</p> <p><b><u>Data/Database</u></b> Azure Data Factory Riak Oracle Application Server</p>	<p><b><u>SAP &amp; Enterprise Business Applications skills</u></b> SAP Oil &amp; Gas SAP IBP (Integrated Business Planning) SAP UI development toolkit for HTML5 (SAP UI5) SAP SD (Sales &amp; Distribution) SAP for Retail (IS-Retail) Oracle Retail SAP Security PeopleSoft (CRM/Financials/HCM) Web Dnipro SAP Point-of-Sale Data Management Baan Oracle HRMS SAP FI - FSCM (Financial Supply Chain Management) SAP MM (Materials Management) SAP EHS (Environment, Health &amp; Safety) Oracle SOA Suite SAP SCM (Supply Chain Management) Oracle HFM (Hyperion Financial Management)</p>	<p><b><u>Systems/Networking skills</u></b> SNA HP Quality Center Apache Flume Mobile device management Virtualization (various) Vagrant Microsoft SCVMM Cisco UCCX Performance Analysis/Tuning Chef/Opencode Network security management IaaS (Infrastructure as a Service)</p> <p><b><u>Management, Process &amp; Methodology</u></b> TIBCO ActiveMatrix BusinessWorks Complex Event Processing/Event Correlation Quality Assurance/QA automation Data Quality Big Data analytics Data Engineering</p>	<p><b><u>Operating System skills</u></b> CoreOS Windows NT SUSE</p> <p><b><u>Messaging &amp; Communications skills</u></b> TIBCO Enterprise Message Service TIBCO Rendezvous Message-oriented Middleware (Wave, XMPP/Jabber, etc.)</p>

Source: Foote Partners [IT Skills & Certifications Pay Index™](#),  
3rd Quarter 2020 data edition

IT CERTIFICATIONS PAY SUMMARY

B. TECH CERTIFICATIONS PAY PERFORMANCE: By Category

**TECH CERTIFICATIONS.** Cash pay for tech certifications is currently at its five-year low. **516 tech certifications** lost even more value overall in three months ending October 1<sup>st</sup>, down an average of 1.5% as 80 changed in value. Pay performance from July to September was lower for all but three certification segments but all certification segments lost value in the twelve-month period ending October 1.

Tech Certifications - % Growth/Decline  
 3 months & 12 months  
 (516 certifications, data through 10/1/2020)

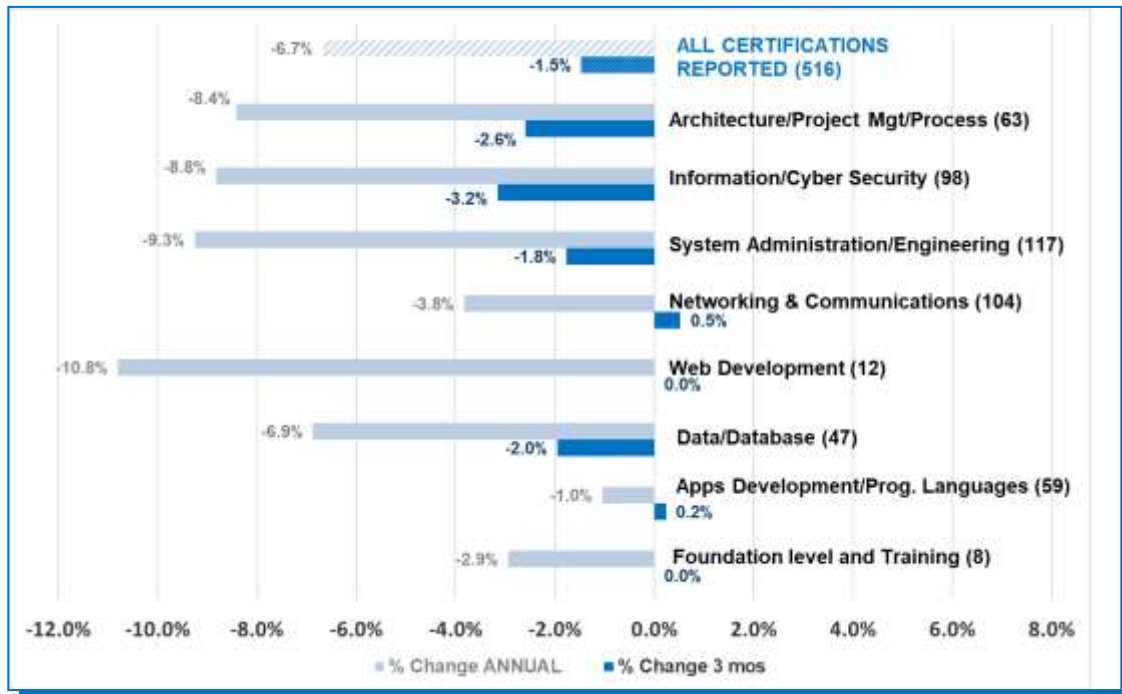


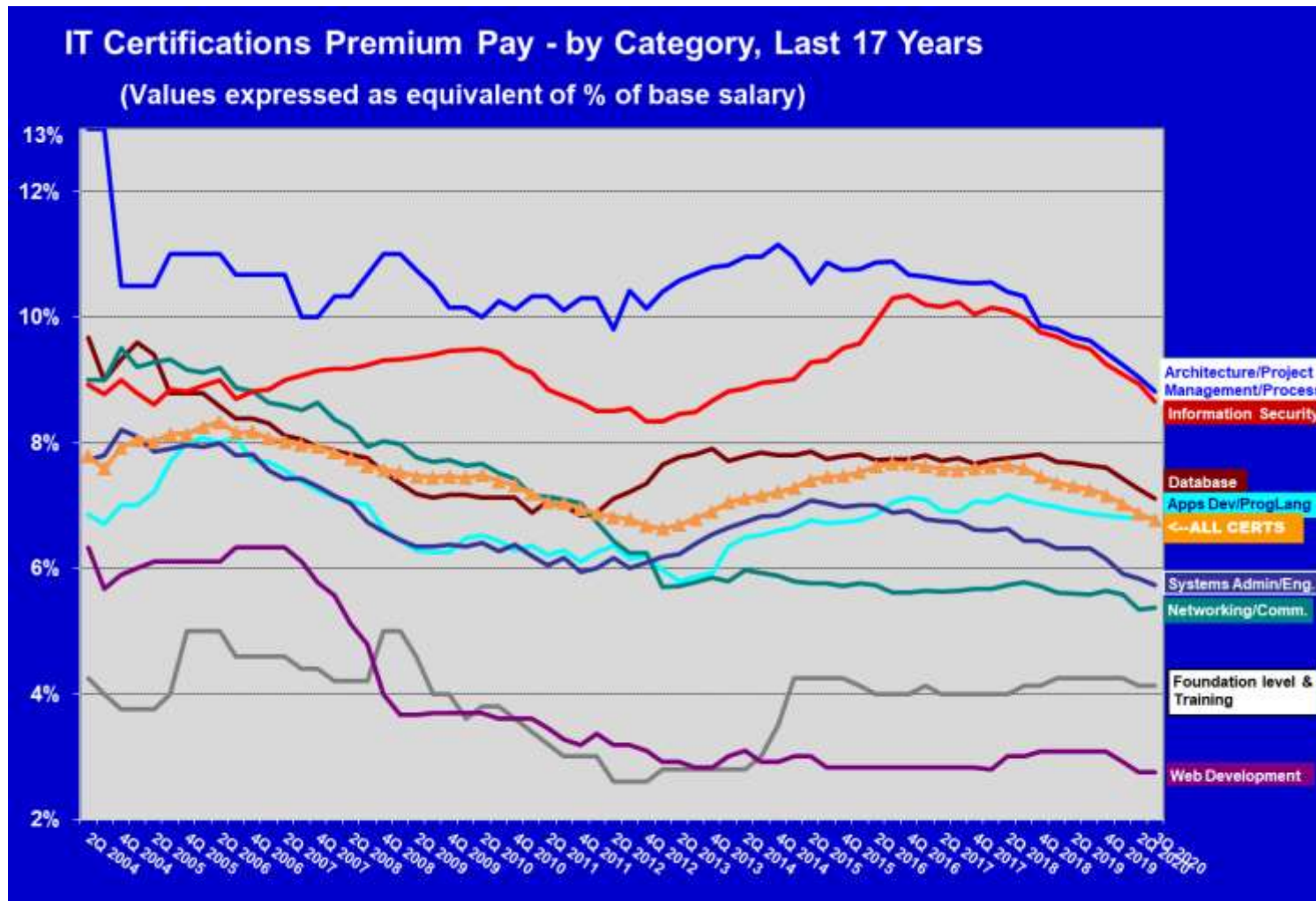
Figure 3

Source: Foote Partners [IT Skills & Certifications Pay Index™](#), 3rd Quarter 2020 data



## 17-YEAR IT CERTIFICATIONS PAY TRENDS BY CATEGORY

Average median cash pay premium for a single IT certification. Data through October 1, 2020 – 81,032 IT Professionals



Pay data supporting these charts available in the [IT Skills and Certifications Pay Index™](#) - 3Q 2020 data edition

## IT CERTIFICATIONS PAY TREND HIGHLIGHTS: Market Value Gainers & Highest Paying – 3<sup>rd</sup> Quarter 2020

These tech certifications *gained 10% or more in market value in the three months ending October 1, 2020* (seen below grouped by segment). *Listed in descending order of amount of % gain in cash pay premium* (including ties). Highest paying skills listed on right in *alphabetical order*.

TECH CERTIFICATION Gainers	Highest Paying – Cash Premiums (A – Z)
<p><b><u>Info/Cyber Security certifications</u></b>            EC-Council Certified Security Analyst (ECSA)            GIAC Information Security Professional (GISP)            Check Point Certified Security Expert (CCSE)            Cisco Certified CyberOps Associate            Systems Security Certified Practitioner (SSCP)</p> <p><b><u>Networking and Communications certifications</u></b>            AWS Certified Solutions Architect - Associate (Cloud)            Cisco Certified Entry Network Technician (CCENT)            AWS Certified Solutions Architect - Professional (Cloud)            Juniper Networks Certified Internet Specialist (JNCIS)</p> <p><b><u>Systems Administration certifications</u></b>            VMware Certified Advanced Professional 6/7 - Cloud                Mgt and Automation Design            Red Hat Certified Systems Administrator (RHCSA)            AWS Certified SysOpsAdministrator-Associate (Cloud)</p> <p><b><u>Data/Database</u></b>            Oracle Certified Professional - DBA (OCP)            Oracle Certified Associate - DBA (OCA)</p> <p style="text-align: right;">Source: Foote Partners <a href="#">IT Skills &amp; Certifications Pay Index™</a>, 3rd Quarter 2020 data edition</p>	<p><b><u>Applications Development/Programming Languages</u></b>            Pivotal Developer            AWS Certified Developer - Associate            Oracle Certified Expert - Java Platform EE Developer (all)            Pivotal Application Architect</p> <p><b><u>Architecture, Project Management, and Process Certifications</u></b>            Certified in the Governance of Enterprise IT (CGEIT)</p> <ul style="list-style-type: none"> <li>• Certified Cloud Security Professional (CCSP)</li> <li>• Certified Computer Examiner (CCE)</li> <li>• Certified Cyber Forensics Professional</li> <li>• Certified Forensic Computer Examiner (CFCE)</li> <li>• Certified ScrumMaster</li> <li>• Check Point Certified Security Expert (CCSE)</li> <li>• Check Point Certified Security Master (CCSM)</li> <li>• Cisco Certified Architect</li> <li>• Cisco Certified Network Professional - Security</li> <li>• CompTIA Advanced Security Practitioner (CASP)</li> <li>• CyberSecurity Forensic Analyst (CSFA)</li> <li>• EC-Council Certified Encryption Specialist (ECES)</li> <li>• EC-Council Computer Hacking Forensic Investigator (CHF)</li> <li>• GIAC Certified Forensics Analyst (GCFA)</li> <li>• GIAC Exploit Researcher and Advanced Penetration Tester (GXPN)</li> <li>• GIAC Security Expert (GSE)</li> <li>• GIAC Security Leadership (GSLC)</li> <li>• Information Systems Security Architecture Professional (ISSAP/CISSP)</li> <li>• PMI Program Management Professional (PgMP)</li> <li>• PMI Risk Management Professional (PMI-RMP)</li> <li>• Zachman Certified - Enterprise Architect</li> </ul>

## IT CERTIFICATIONS PAY TREND HIGHLIGHTS: Market Value Losers – 3<sup>rd</sup> Quarter 2020

These tech IT certifications **declined 10% or more in market value in the three months ending October 1, 2020** vs. prior quarter (grouped by segment).  
**Listed in descending order** of amount of % decline, including ties.

### TECH CERTIFICATIONS Losers

#### Application Development/Programming

##### Languages

Oracle SOA 12c Infrastructure Implementation Certified Expert  
Oracle Certified Professional - Java EE Web Services Developer  
Oracle Certified WebLogic Server System Administrator Certified Expert

##### Data/Database

SAS Certified Data Scientist Using SAS 9  
SAS Certified Statistical Business Analyst - SAS 9  
SAS® Certified BI Content Developer for SAS®9  
SAS® Certified Data Quality Steward for SAS®  
SAS Certified Predictive Modeler - SAS Enterprise Miner 14  
SAS Certified Big Data Professional Using SAS 9  
SAS Certified Data Integration Developer for SAS 9

##### Networking and Communications

Juniper Networks Certified Internet Professional  
Cisco Certified Network Professional - Enterprise (was CCNP Routing and Switching)  
Cisco Certified Network Professional - Enterprise (was CCNP Wireless)

#### Systems Administration certifications

CompTIA Linux+  
VMware Certified Advanced Professional 6 - Data Center Virtualization Deployment  
Linux Professional Institute certification (LPIC-Level 3)  
VMware Certified Professional 6/7 - Cloud Mgt and Automation  
HP Accredited Integration Specialist (AIS)  
HP Accredited Solutions Expert (ASE - all)  
Microsoft Certified Solutions Expert: Server Infrastructure  
VMware Certified Professional – Desktop and Mobility 2019  
VMware Certified Professional 6 - Data Center Virtualization (VCP6-DCV)  
VMware Certified Professional 6.5 - Data Center Virtualization (VCP6.5-DCV)  
VMware Certified Professional 6/6.5  
VMware Certified Design Expert - Cloud Mgt and Automation  
VMware Certified Design Expert (all)  
VMware Certified Design Expert 6 - Data Center Virtualization

#### Info/Cyber Security certifications

Information Systems Security Architecture Professional (ISSAP/CISSP)  
Information Systems Security Management Professional (ISSMP/CISSP)  
GIAC Mobile Device Security Analyst (GMOB)  
EC-Council Licensed Penetration Tester (LPT)  
Information Systems Security Engineering Professional (ISSEP/CISSP)  
Certified Secure Software Lifecycle Professional (CSSLP)  
GIAC Critical Controls Certifications (GCCC)  
GIAC Certified Unix Security Administrator (GCUX)  
GIAC Certified Windows Security Administrator (GCWN)  
GIAC Secure Software Programmer-- .NET  
GIAC Network Forensic Analyst (GNFA)  
GIAC Secure Software Programmer--Java  
GIAC Certified Perimeter Protection Analyst (formerly GCFW)  
GIAC Cyber Threat Intelligence (GCTI)  
GIAC Python Coder (GPYC)  
GIAC Certified Project Manager (GCPM)  
GIAC Systems and Network Auditor (GSNA)  
Check Point Certified Security Administrator (CCSA)  
GIAC Certified Incident Handler (GCIH)  
GIAC Certified Intrusion Analyst (GCIA)

Source: Foote Partners [IT Skills & Certifications Pay Index™](#), 3rd Quarter 2020 data

**IT CERTIFICATIONS PAY TREND HIGHLIGHTS: Market Value Losers – cont'd**

**TECH CERTIFICATIONS Losers – cont'd**

**Architecture, Project Management, and  
Process Certifications**

Six Sigma Green Belt  
Six Sigma Black Belt  
PMI Certified Associate in Project Management  
(CAPM)  
Six Sigma Yellow Belt  
ITIL Intermediate Certification  
Prince2 Foundation  
ITIL Expert Certification

Source: Foote Partners [IT Skills & Certifications Pay Index™](#), 3rd Quarter 2020 data edition

## 4Q 2020 Pandemic Tech Labor Trends Discussion & Analysis

Data collected through July 1, 2020 to October 1, 2020

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – 3<sup>rd</sup> Quarter 2020

### AS THE PANDEMIC TURNS

2020 began with a bang for IT professionals with 31,300 tech jobs added to U.S. payrolls in the first three months according to the U.S. Bureau of Labor Statistics (BLS). But soon the bottom dropped out, with the BLS reporting a stunning loss of 210,000 tech jobs from April to July. But August and September saw a turnaround with a net 25,600 tech jobs added back to U.S. payrolls and more expected in the final three months of 2020. Two important tech categories are signaling a recovery of the all-important IT professional services industries: *Management & Technical Consulting Services* has added nearly 30,000 net jobs since May and *Computer Systems Design & Related Services* has gained 24,500 new jobs in August and September.

That said, with a total estimated U.S. workforce of 12.2 million tech jobs, it can be argued that there has barely been a dent in the national technology workforce as a result of the pandemic and economic recession. What there has been is a larger workforce disruption that has had very real consequences for employers. Sure, tech job openings have increased recently but tech's recovery is progressing in "fits and starts", a humbling reminder of COVID-19's bruising impact as parts of the country grapple with resurgent outbreaks.

Initially, tech was holding up better than other sectors due to the quick adaptation to remote work. But nationally, as the long-term effects of the pandemic have started to sink in, tech job growth has hit some monthly flatlines. That's the key change—the economic expectations around the virus went from short-term thinking to "we'll be in this for the long haul".

Clearly, for those of us who analyze the tech workforce and forecast tech labor markets the elephant in the room is how the economy recovers during an ongoing COVID-19 pandemic and how employers are able to adjust to this recovery. We've already discovered its impact on salaries: [41% of the salaried job titles in our \*IT Professional Salary Survey\* have declined in value in the last twelve months \(using national average salary in our comparison\)](#).

It's difficult to say with accuracy what lies ahead for tech jobs but one thing is already certain: before the pandemic employers were already struggling mightily with devising and building successful tech staffing models to meet their future and present needs and now these objectives have become even more elusive. In fact, it's almost idyllic to think that prior to the pandemic the most common challenge shared by employers was balancing three things: the urgencies of digital transformation, combating ever deepening security threats, and at the same time keep increasingly complex systems and networks running smoothly and efficiently.

The pandemic and subsequent economic recession has created a new set of assumptions influencing the tech labor market and demand for skills going forward. Here are just a few:

- Predatory hiring practices, principally by large employers
- Need for significant up-skilling and retraining
- Reduction in workforces, including middle management jobs, similar to 2008 Great Recession
- Stay-at-home workforce continuing after pandemic winds down for some (but not all) employers, creating significant changes for those employers to navigate
- Acceleration of automation...including artificial intelligence
- Amped up digital transformation

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

But despite all of these new pressures on businesses and our private lives, one thing remains unchanged: technology evolution will continue to flourish, unaffected. The history of modern technology has been one of tech innovation consistently exceeding our human ability to adopt the solutions they offer. There are a lot of reasons for this, chief among them our natural resistance to changing our behavior.

***How long will the COVID-19 pandemic last?*** This is, of course, the key question for forecasting the state of the economy and in turn the future of tech employment. Foote Partners has looked at several variables and spoken with experts in the fields of immunology, epidemiology, healthcare, social sciences, and economics. We not only base our predictions on past economic upheavals and how the tech job market reacted, but also on what may constitute a new normal given the likelihood that society will be learning to live with virulent strains of the flu for years to come.

Of particular concern to us is the latest data on the public's acceptance of vaccines. Prior to this pandemic the percent of Americans who routinely opposed vaccinations of any kind had been reported to be in the 16% to 20% range. But this has now changed: [a recent survey](#) of 10,093 U.S. adults conducted September 8-13, 2020 by the Pew Research Center found that about half of adults (49%) say they would "definitely not" or "probably not" get a vaccine to prevent COVID-19 if it were available today. This is up from 27% in a similar survey conducted from April 29 to May 5, 2020.

Assuming the development of an effective vaccine for this coronavirus, the acceptance of this vaccine and how efficiently a vaccine can be distributed globally are key factors we included in our forecast. So is the impact of mutations of SARS-CoV-2 which at this time is inconclusive. In September, CDC Director Robert Redfield testified before Congress that most of the American public will not have access to a vaccine against the novel coronavirus until late spring or summer of 2021.

On the economic front, macroeconomists are citing historical evidence and the state of current indicators such as the current-account deficit, the so-called net national savings rate, and recent economic output trending in suggesting the specter a U.S. dollar collapse against other currencies as early as the end of 2021. The odds of a "double-dip" recession in the U.S---defined as a recession followed by a brief recovery and then another recession---is as high as 50% is the estimation of some leading macroeconomists.

Considering all data and insights we have collected and analyze, ***our forecast is that we will likely not see anything resembling a sense of 'normalcy' in the U.S. until the fourth quarter of 2022.*** Exactly what the definition of normalcy will be is uncertain. What will be less ambiguous, we believe, is that will not be until late 2022 that many Americans feel a general sense of relief that controls have been put in place to ensure their safety and their futures have become more predictable.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

### UNDERSTANDING THE NEW LABOR LANDSCAPE

According to an October report entitled [\*The Future of Jobs 2020\*](#) published by the World Economic Forum (WEF), advances in robotics and artificial intelligence will lead to a net increase in jobs over the next five years but the coronavirus pandemic will result in “double-disruption” scenario for workers. That is, in addition to the current employment disruption from the pandemic-induced lockdowns and economic contraction, technological adoption by companies will transform tasks, jobs and skills by 2025. Forty-three percent of businesses surveyed indicate that they are set to *reduce their workforce* due to technology integration, 41% plan to *expand their use of contractors* for task-specialized work, and 34% plan to *expand their workforce* due to technology integration.

In a stunning prediction the WEF believes that by 2025 the time spent on current tasks at work by humans and machines will be equal. Moreover, the report predicts that in the next five years a significant share of companies also expect to make changes to locations, their value chains, and the size of their workforce due to factors beyond technology.

The WEF believes that the rise of machines and automation will eliminate a huge 85 million jobs by 2025 while at the same time creating 97 million new jobs, meaning an overall addition of 12 million jobs globally. This will require employers to achieve a significant level of “reskilling” and “upskilling” to ensure staff are sufficiently equipped for the future of work. According to the WEF, half of all employees will need some level of retraining in the next five years, a very short window that will require an intensive effort from business, government and the workers themselves. In this study 94% of business leaders report that they expect employees to pick up new skills on the job, a sharp uptake from 65% in 2018.

The WEF report also highlights the rapid shift to remote work that came about in the spring as the health crisis led companies to close their offices. It predicts employers will move as much as 44% of their workforce to operate remotely but more than three-quarters of business leaders surveyed expect current ways of working to negatively impact productivity as some industries struggle to adapt. To address concerns about productivity and well-being, about one-third of all employers according to the WEF expect to also take steps to create a sense of community, connection and belonging among employees through digital tools, and to tackle the well-being challenges posed by the shift to remote work.

The WEF identifies twenty job roles increasing in demand including these fourteen tech and tech-business hybrid roles in rank order of demand:

- Data analysts and scientists
- AI and machine learning specialists
- Big data specialists
- Digital marketing and strategy specialists
- Process automation specialists
- Business development professionals
- Digital transformation specialists
- Information security analysts
- Software and applications developers
- Internet of things specialists
- Project Managers
- Database and Network Professionals
- Robotics Engineers
- FinTech Engineers



## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

### A Word About the Future of Remote Working

We all know that work will never be the same because of the pandemic, even if we don't yet know all the ways in which it will be different. What can be said with certainty is that the sudden shift to distributed work has provided a once-in-a-generation opportunity to reimagine everything about how we do our jobs and how we run our companies. If we can move past decades of 9-to-5 office-centric orthodoxy about work, there's an opportunity to retain the best parts of office culture while freeing ourselves from bad habits and inefficient processes, from ineffective meetings to unnecessary bureaucracy.

Companies are gaming out how to bring employees back to the office but many are expecting a new normal in which a significant portion of their workers stay home for good. Some may find they are just as productive with a remote workforce but a shift away from in-office work will have profound impacts on everything from the commercial real estate market to the vast number of jobs that have been built in and around urban areas.

Some tech companies like Twitter have told workers that they can work from home permanently if they want. Others haven't gone that far: they have acknowledged publicly or privately that they don't expect most workers to return to the office this year. From the employee perspective, the shift is massive and very consequential: workers are making new choices about where they want to live and creating new expectations about flexibility, working conditions and life balance that arguably can't be undone. One recent survey of 4,700 knowledge workers found the majority never want to go back to the old way of working. Only 12% in this survey want to return to full-time office work, while 72% want a hybrid remote-office model moving forward.

Recently the CEOs of Box, Okta, PagerDuty and Twilio all expressed a sense that they will end up with more remote workers permanently even after the pandemic ends, and admit that prior to the pandemic they were already trying to reduce dependency on a workforce residing principally in high cost of living areas.

Many employers have had to quickly switch gears, searching for and finding benefits in having a larger remote workforce. Remote meetings have been an acceptable and a more efficient substitute for talking in person, especially for teams in other countries. The truth is that embracing remote work has a number of benefits for companies beyond just the costs of hiring and retaining workers. For example, many companies have built up a massive army of contractors and vendors to support their employees, including not just knowledge workers but also food service, shuttle bus drivers and janitorial staff. Even a partial shift away from the office can likely add up to significant savings over time for these companies.

Meanwhile, for workers, the ability to work remotely means more than just cutting down a commute. It also means the ability to live wherever they want rather than being tied to expensive urban areas such as the San Francisco Bay Area, Austin, New York and Boston. Considering the high cost of real estate and other expenses in these cities are areas, this could lead to a significant exodus and so far indications are that many workers are taking advantage of these policies---and often taking reductions in salary as their employers seek to equalize pay for these relocations from high-cost to lower-cost locations.

For those who can work from home (approximately 40% of US workers largely from the higher educated quartile), their daily experience of work has and will change significantly. Commuters may gain an hour back on average in their day and estimates suggest that post pandemic, some portion of the week will involve working from home – from one to three days a week. The hybrid model referenced above is likely to emerge that will try to balance the efficiencies gained by remote work with the benefits of social interactions and to creativity and innovation generated by working in person with others. This model will most benefit corporate cultures that prioritize trust and belonging, where interpersonal bonds are formed with intent and care.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

### *Remote Working, cont'd.*

But the greatest challenge that we face regarding work is what happens to the other 60% of workers who can't work from home. The decline in daily commuters as well as business travel has a knock-on effect on those whose jobs support and serve these workers and offices. A full one-in-four of U.S. workers are in the transportation, food service, cleaning and maintenance, retail and personal care industries. These jobs, often concentrated in cities and lower paid, are disappearing or are at risk of disappearing in the near term. The federal and state governments will need to shore up the social safety net and invest in ways to further skills and increase access to education and training for our most vulnerable workers.

Still, not all employers are on board with enlarging their permanent remote workforce. Some companies have invested significantly in their campuses and have a vested interest in maintaining an office culture. A prime example is Apple, which spent a fortune on its Apple Park HQ and likes its products designed behind closed (and locked) doors.

The big picture is employers' stances will range from "stay home forever if you want" to "can't wait for you to come back in." Among tech sector companies, software companies are likely to have an easier time than hardware producers relying on a largely distributed workforce. Not all the changes we are seeing as a response to the coronavirus will be permanent. Some jobs that are being done remotely at the moment, including many roles in sales and support, will require more travel once shelter-in-place rules ease.

\* \* \*

As companies create jobs that require the skills to implement emerging technologies such as artificial intelligence/machine learning (AI/ML), robotic process automation, and blockchain, IT and HR managers will have to understand the landscape of tech jobs and skills needed to identify the right pool of talent.

### **Acceleration of automation**

For years, companies have been working toward automating repetitive jobs through algorithms that can complete administrative tasks, robots that can streamline manufacturing and drones that can deliver goods. Our recent findings are that the coronavirus and subsequent economic downturn has caused an acceleration in automation-related labor trends, in effect pulling the future forward. In warehouses, for example, some companies may be looking at more physical automation or robotics to do the work in order to protect people and avoid the situation that Amazon experienced with a number of ill warehouse workers. Other robotics have been under evaluation in retail settings to help check inventory---an important job during this pandemic when shelves have been periodically emptied of essential goods. But none of these physical robotic solutions are quick fixes.

Forced to tighten their belts financially by the coronavirus pandemic, organizations will also accelerate their use of robotic process automation (RPA) and software to eliminate administrative-type back-office tasks and jobs. The technology handles repetitive duties; the idea, of course, is for companies to save money by reducing the number of workers they need to handle clerical work. Although RPA has existed for years, recent advances in machine learning and natural language processing have made it possible for it to do more complicated tasks. That includes deciphering financial jargon in PDF documents, analyzing that data, and then using it to fill in information in spreadsheets, which is helpful for cataloging invoices, among other tasks.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

There is debate about which jobs are most at risk and how soon. Rather than regarding this as a driver of mass unemployment, we believe this trend will not only persuade out-of-work workers to develop new skills in order to find new jobs but also drive massive tech workforce up-skilling and retraining efforts within organizations intent on capitalizing on the promises of automation. The automation space will create job opportunities as well. Climbing up the skills ladder is the best way to stay ahead of the automation wave.

### Redoubling cybersecurity protections

The pandemic has unfortunately given rise to an increase in the threat landscape with cyberattacks spiking during the first half of 2020. According to the FBI, attackers have found new ways to exploit the conditions brought on by widespread lockdowns: as of May 28, 2020, the FBI's Internet Crime Complaint Center received nearly the same amount of complaints in 2020 as they had for the entirety of 2019. They also cite evidence that criminals have launched new fraud efforts aimed at diverting Paycheck Protection Program funds, economic stimulus checks, and unemployment checks into their own pockets. Moreover, a survey conducted by security vendor CrowdStrike found a 100X increase in COVID-19-themed malicious files from February to April 2020.

Of course, global cybercrime costs have been growing for years, projected to be \$6 trillion in 2021 with cumulative global spending of cybersec products and services combat cybercrime reaching \$1 trillion for the five years ending 2021. Now we have a pandemic that will push those numbers even higher. What should employers do to fight back?

First you need to secure your endpoints. Anecdotally, [one security vendor](#) says that attacks on one customer's APIs spiked up 297% in late April, sometimes exceeding 100,000 malicious requests per minute and that total attacks continued to increase 85% week over week in subsequent months. These attacks will continue to escalate, so developers need to look at how to limit the value for anyone gaining access. If they are unable to steal useful information (data or code), the API becomes less attractive as a target, so locking down APIs becomes an in-demand skill area. Also, in demand will be secure coding and efforts to tighten up your code, paying particular attention to known vulnerabilities. Recent studies report that 70% of applications examined included open source code with security flaws. Relying on open source code can reduce development time for applications, but organizations need to make sure that they are maintaining that code and applying patches to open source libraries as they become available.

Clearly, demand for cybersecurity workers is not being met by supply and that gap has been highly publicized to be 6+ million shortfall. More employers will need to internally develop next-gen cyber experts who can develop and drive interconnected real-time systems. New professions and domain expertise will evolve, in particular the focus on hiring and supporting a team of machine learning experts to build custom cybersecurity solutions using existing hybrid tools and embedded AI tech in human-operated products. There will be greater reliance on A.I. smart tools to handle the bulk of event monitoring and incident response. The next generation of firewalls will have machine learning technology built into them, allowing the software to recognize patterns in web requests and automatically block those that could be a threat.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

**A.I./cybersecurity staffing connection.** To cope with the shortfall in seasoned cybersecurity professionals, and those with AI/ML expertise in particular, we believe CSOs, CISOs and other security leadership have their work cut out for them in both governance and staffing areas.

To deliver long-term improvement transparently and ethically all employers must first install effective governance for A.I. in cybersecurity, addressing these objectives in their security architectures:

- Defining roles and responsibilities for cyber staff
- Monitoring AI algorithm output by cyber analysts before any action is taken
- Implementing a mechanism to monitor AI algorithms' output logic and upgrades
- Creating control processes to monitor if an AI algorithm is behaving abnormally
- Identifying the risk tolerance for the output generated by AI algorithms
- Instituting a 'plan B' if AI algorithms fail or are tampered with
- Implementing key performance indicators to measure success

In defining roles and responsibilities for an A.I.-ready cyber staff, security management should strive to meet these critical capability requirements:

- Capable of improving the logic underpinning A.I. algorithms
- Capable of building algorithms that suggest and store complex passwords
- Process expertise
- Upskilling workers with organizational knowledge of 'how things work' at their company
- Create interfaces for cyber analysts to interact with A.I. tools and incident alerts

Companies spent an estimated \$137 billion on cybersecurity risk management in 2019 according to Gartner. An increasing amount of this cybersecurity spending is focusing on AI/ML---and so should tech professionals in their career planning. Here are the most common AI supported use cases as a guide for how managers and workers might want to target recruitment and job searches, respectively:

- Augmentation of human security analysts and SOC workflows
- New attack recognition
- Behavioral analytics and risk scoring
- User-based threat detections
- On-device detection across the endpoint kill chain
- Proactive security in disconnected environments
- Big data query generation and analysis
- Threat proliferation and spread detection analysis
- Autonomous response
- Threat blocking automation
- Malware detection and classification
- Agent consolidation and deployment across other security tools
- Attack classification (unknown, insider, persistent)
- False positive reduction
- Product self-healing
- Machine data comprehension
- Encrypted traffic analysis
- Policy compliance analysis
- Cyber-risk insurance
- Cyber-risk due diligence augmentation (pre-mergers and acquisitions)

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

**Hot info/cybersecurity jobs in 2020-21.** Our research indicates the following info/cybersecurity jobs and domains for the next two years.

- A.I. / Machine Learning
- Access/identity management
- Advanced malware prevention
- Analytics and intelligence
- Application security development
- Audit and compliance
- Automation
- Cloud computing/virtualization
- Cloud security
- Cyber Threat Intelligence
- Cybersecurity
- Data Security
- DevSecOps Firewall/IDS/IPS
- Incident handling and response
- Intrusion prevention/detection systems
- Mobile security
- Network access control/Identity mgt systems
- Network security management
- PenTesting (Apps, System Security)
- Risk analytics/assessment
- Risk management
- Security Architecture & Privacy
- SIEM management
- Web services security
- Wireless security

**In-demand Cybersecurity Certifications in 2020-21.** Data and growth vectors recorded in our long-running *IT Skills and Certifications Pay Index™* (published and updated every three months since 2000) point to the following security-related certifications as good job and career investments for the next two years.

- Certified Cyber Forensics Professional
- Certified Information Security Manager
- Certified Information Systems Auditor (CISA)
- Certified Scrum Product Owner
- Certified Secure Software Lifecycle Professional (CSSLP)
- Cisco Certified Network Professional – Security
- Citrix Certified Expert - Networking
- CompTIA Advanced Security Practitioner
- CompTIA Cybersecurity Analyst+
- Cybersecurity Forensic Analyst
- EC-Council Computer Hacking Forensic Investigator
- EC-Council Certified Encryption Specialist (ECES)
- GIAC Certified Forensics Examiner
- GIAC Certified Incident Handler
- GIAC Certified Penetration Tester
- GIAC Enterprise Defender
- GIAC Exploit Researcher and Advanced Penetration Tester
- Microsoft Certified Solutions Expert: Data Management and Analytics
- SAS Certified Data Integration Developer for SAS 9
- Six Sigma certifications

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

***Diversify your security team.*** Our vast network of employer/research partners tell us that info/cyber teams benefit from workers with different backgrounds, approaches and personalities who approach cybersec situations from completely different angles. Degrees in psychology and law and those who have a criminal justice background have proven to be effective hires as are hires who can “think like a criminal”.

In addition to considering people with nontraditional backgrounds to combat diverse threats, we suggest targeting cyber potential within IT organizations. IT-skilled people working in networking, software development, systems engineering, financial and risk analysis are smart choices according to our findings. *Feeder skills* include system administration, firewalls, routers, Linux or iOS OS, VMware, and virtual machines open source software

***Review your business continuity/disaster recovery plans.*** While the pandemic has not resulted in data center outages, the next crisis very well could, making a disaster recovery (DR) plan essential. Most enterprises have a DR plan, but many don't test those plans as often as they should. If you don't have a regular testing schedule or you test it only once a year or less, now is a good time to think about getting on a better schedule. Remember that you also need to maintain your DR plan. As your IT environment changes, you will likely need to update your DR plan in response. In addition, now would be a good time to incorporate some of the things you've learned from the pandemic into your DR plan.

### **Containerization expands**

Another trend that was well underway before the pandemic was the increasing use of containers. Containerization software like Docker and Kubernetes can simplify IT management, reducing the burden on IT in a time of crisis. Containers also make it easier to move workloads from one environment to another, which can also be helpful in a disaster situation. While it's impossible to be fully prepared for a crisis, with regard to IT, technologies like Kubernetes can help organizations lower their TCO by improving resource efficiency within their hybrid cloud infrastructure, which has proven critical in the face of distributed and remote work forces. A proactive approach to digitization and commitment to containerization is should be a consideration for tech professionals preparing their careers future crises.

### **Networking technologies for expanding virtual business models and a remote workforce**

During the pandemic crisis---and especially coming out of the pandemic---companies will increasingly be examining how they do networking and communications. Solutions and skills that support the virtual business operating model will be excel, including higher bandwidth connections such as 5G, software-driven technologies, and distributed data sourcing and storage. This will be driven an organizations insistence on accelerating their ability to provide a more flexible, agile, protective, proactive, virtual, and fast-moving technology infrastructure. Skills related to network and cloud security, as well as business continuity and data recovery, will be in demand as well. The rise of the remote worker has also led to greater demand for people with the skills to resolve network access issues and optimize network connections. For those moving to the cloud, a need has arisen for good QoS [quality of service] and bandwidth control.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

### Cloud adoption increases

Organizations with lower overhead costs are in a better position to weather the current financial turmoil. Better optimizing your public cloud usage or by auditing software licenses are strategies for eliminating unnecessary expenses. Most enterprises were well on their way transitioning toward the cloud before the pandemic began, but the crisis has made cloud seem even more attractive than before. Cloud-based apps make it easy for employees to do their work whether they are at home or in the office, and cloud computing can also reduce the management burden on IT and help control costs. Businesses that have already adopted cloud services because it makes access to their servers and data more ubiquitous and extensible can easily plug-in solutions that allow for faster and easier remote working at scale. Those that have resisted the move will now be facing questions around how to move servers and applications to the compute cloud and how to get the data integrated into their cloud architecture. For tech professionals our firm has been publishing salary data and detailed job descriptions with key skills, knowledge and experience for a wide range of cloud family jobs since 2007.

### Big Data and IoT explodes

There will be 31 billion connected things by the end of 2020 and as many as 75 billion by 2025 according to some estimates made prior to the COVID pandemic. Moreover, global spending on the Internet of Things (IoT) is estimated to reach 1.29 trillion this year and the global IoT device market reaching \$1.1 trillion by 2026. The effect of this explosion in sensors and devices on big data analytics and cyberthreat levels should be obvious. Not as obvious to some are these drivers and the skills in demand for each:

- The shift from ad hoc analytics use cases to operationalizing production quality Big Data pipelines
- Rise of real-time streaming analytics
  - Skill areas: NewSQL databases, in-memory data grids, and dedicated streaming analytic platforms converging to enable ultra-fast processing of streaming analytics. Enabled by SQL capabilities in open source streaming frameworks like Kafka, Spark, and Flink
- Merging of BI/Analytics, data science, and data engineering teams and skill sets
- Rise in cloud-based and containerized identity and access management (IAM, Idea's) services (13% CAGR next six years, to \$24 billion)
- Rising demand for workers experienced with supervised algorithms and unsupervised learning, effective in identifying anomalous behavior and triggering reduced or restricted access.
- Nation-sponsored organizations will continue to develop cyber-attack technologies for defense and offense, as attackers have access to "strategic weapons" that don't require the infrastructure or the cost of conventional weapons.
- Countries and states will have a bigger role in protecting large scale environments (power grids, water supply, traffic control, etc.) and maybe even to provide some of their intelligence to the public

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

There are many hot jobs to be found in the Big Data/IoT space...here are a few, and why.

- **Big Data Development Engineer.** There are many applications for big data across lots of industries and the demand for skilled, big data development engineers is growing. Due to the massive amounts of data, it has become more and more difficult to manipulate and analyze data ultimately extract value information from it. No matter the level of technical depth or development, demand for this position will continue to increase in the future. There are several hard skills required: SQL, programming, exploratory analysis skills, Hadoop/parallel processing, machine learning and data mining. As for the soft skills, the ability to model, optimize and simulate. have gained much popularity recently. Big data development engineers should be willing to constantly upgrade skills and accumulate practical experience.
- **Database Administrator.** Many projects need database support and this position is engaged in the management, maintenance, and security of database systems. Among other duties, they install, back up, update and patch databases, as well as ensure database access, completeness, and coherence. It is a critical role because the loss of sensitive information could be catastrophic for companies and organizations. Key skills needed for the job include fluency in SQL, UNIX, and databases such as Oracle, MySQL, PostgreSQL, and, Oracle Database.
- **Data analyst.** The responsibilities of this position includes developing frameworks for data, analytics, and strategy development; implementing data-analysis tools; providing user training; collecting and analyzing data sets from diverse sources to inform business decisions and make accurate predictions; tracking and monitoring internal and external data. Key skills needed for the job include an ability to analyze large data sets and filter relevant data sets; attention to detail; an analytical mind, problem-solving ability; experience in data modeling and reporting software; and the ability to write actionable reports in clear language
- **Data engineer.** Incumbents in this position build systems to handle big data; design, develop, build, test, and maintain architectures, including databases and large-scale data-processing systems; find ways to acquire and filter data; develop high-performance algorithms for data use, such as predictive modeling and proof of concepts; and create and implement disaster-recovery plans. Key skills needed for the job include: Knowledge of Hadoop-based technologies, SQL-based technologies, NoSQL technologies, data-modeling tools, and various coding languages including Python, C/C++ or Java, Perl; statistical analysis and modeling; predictive modeling; neuro-linguistic programming, machine learning, and text analysis experience.

### Middle management erosion?

In the months and years ahead, we could continue to see a hollowing out of middle management similar to the aftermath of the global financial crisis in 2008. Promotions into management were fewer which had a negative effect of wage growth as workers were not promoted to middle-management roles as frequently. There is some cause for optimism however: the demand for top-tier managers could rebound once the pandemic subsides because organizations will want to emphasize productivity. The fear here is that with fewer managers required to oversee a higher volume of direct reports, this creates room for error and lack of oversight.



## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

### Don't Forget About the Marketability of Soft Skills

A time of crisis results in greater stress for everyone, but teams with strong interpersonal relationships are better able to cope with emergencies as they arise. Right now, a majority of enterprise IT professionals are working from home, which can make it much more difficult for groups to communicate; managers know that it is harder to build relationships with co-workers and among workers when working remotely. To compensate, team members are encouraged to make frequent and expert use of collaboration tools and video communication tech to stay in close communication with their co-workers. Clearly, team relationships will be a lot closer if they're able to move back into the workplace and retire some of the messaging habits gained during quarantine times, although some who we interviewed believe that a generally more agile way of working and communicating with colleagues will continue. More meetings will become emails, and more emails will become instant messages.

For managers, if there is budget for training, strong consideration should be given to investing in their teams' "soft" skills as well as their technical skills. For tech professionals, they should be alert to the value of their soft skills in their overall branding when contemplating job opportunities.

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### REPAIRING AND PREPARING YOUR TECH WORKFORCE

A snapshot of today: a reported 80% of the global workforce is in some form of lockdown...33% of the population is unemployed...the global supply chain is massively disrupted...medical practitioners are ordered to shut down...physical distancing is mandated...and in the U.S. a food supply panic sweeps the nation. Yet thanks to technology, many businesses have continued operating with some degree of normalcy. Technology systems have safe-guarded supply chains; remote communications have been leveraged in education, medical services, customer services, logistics, and entertainment; and essential businesses like commerce, insurance, and finance have continued providing services online. In short, technology has played a vital role in enabling our economy to survive.

The tech staffing challenge has now moved well beyond quick fixes. More than ever, hiring managers need to think about their tech staffing requirements strategically over the next few years, define specific tech skills that will be required and at what bench strength and not rely on consultants and contingent workers to solve their skills gap problems. They need to configure a roadmap for how to get there so that they're not scrambling for talent last minute when the time comes.

We conducted interviews from early-to-late 2020 with 350+ senior tech execs and decision makers across 40 industries to inquire about their tech workforce plans. Many execs were conspicuously stressed out about this subject. They sensed harder tech labor challenges in 2020 than any year in recent history and this was before the pandemic took hold. They were open about 'people problems' getting exponentially worse unless their companies begin laying the groundwork right now for a new strategy for staffing.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

What concerned them most prior to the arrival of COVID-19 were game-changing emerging technologies that have been altering the landscape of not just businesses but the private lives of billions of people. Layered into all of these is also a requirement to build deeper cybersecurity capabilities for the escalating threat levels that these disruptors have created:

- Next-gen Internet of Everything
- AI-driven development
- Blockchain
- Mobility
- Big Data//Information Integration/ BI analytics
- Cybersecurity
- Hyperautomation/Robotic Process Automation
- Autonomous things
- Multiexperience Platforms
- Edge computing
- Distributed Cloud computing
- Healthcare tech/IoMT/Telemedicine
- Carbon-reducing technology/exponential energy

Some execs believe that the coronavirus pandemic will undoubtedly create an acceleration in labor trends such as automation and 'going digital' at their companies as they are forced to find ways to operate with fewer employees physically present. But at the same time there will need to be a significant up-skilling and retraining, especially for laid off workers looking to re-enter the labor market.

We also heard many opinions about the amped up stay-at-home workforce remaining in place after the pandemic winds down. With tech professionals balancing the demands of work life and home life all in the same place, employers have relaxed rules about the number of hours their workforces are working which makes sense: it's just a lot harder for employers to deny flexibility around work hours and work settings. The execs and decision makers we interviewed are increasingly calibrating expectations for when they need everyone in the office or online for staff meetings and other team activities.

Altogether this amounts to a massive transformation of the technology and tech-business hybrid workforce as the focus becomes how to deliver on a wide variety of new operational solutions and revenue-generating opportunities. And all of these prospects depend on solving a puzzle: how to get the mix of critical technology and business skills and experience *just right* when shortages of skills and talent have never been more constraining to business transformation, and to do it during pandemic uncertainties.

***Tech neutral versus tech driven matters.*** We believe the pandemic will not have a negative impact on technology evolution, a fact that has been proven time and again with past market interruptions. Evolving technology always seems to barrel down the train tracks at breakneck speed no matter what, often out-distancing the ability of humans to adopt it or quickly turn it into drivers of competitive advantage, market share, or profitability.

But what this COVID chaos will change is how various employers and industries choose to invest in technology now as their normal revenue channels are disrupted. For example, industries most directly negatively affected by the pandemic—transportation and tourism, hospitality, restaurants, fitness/gyms, arts and entertainment, and local government—are all buyers of technology but relatively 'tech neutral' in their overall business strategy. Their relationship with their technology vendors and service providers has and will continue to change. Winners in the pandemic have been telecommunication, grocery, e-commerce, fintech, digital media, sporting goods, and logistics/warehouse management who are more tech driven in their business models.

TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

So too has this pandemic tipped the scales in favor of large employers with vast cash reserves and unwavering customer bases such as Amazon, Alphabet/Google, Facebook, Netflix and Apple who can finance ferocious predatory behaviors in local tech talent markets stunned by recent developments. Our interviews and recent data from companies in our 3,640 research partner network has revealed many stories of 'surgical' labor losses by aggressive recruiters targeting specific individuals and also clusters of highly valued talent in specialized skill areas and product domains. Many employers caught in the haze of pandemic confusion never saw these critical talent losses coming and had only withering defenses to combat their talent defections.

The upshot of all Foote Partners statistical data and empirical research is that the remainder of 2020 and 2021 will continue to be dominated by responses to the novel coronavirus and the trend of employers taking stock in how poorly prepared they are from a talent perspective for consuming revolutionary new technologies. If these new blockbuster technologies existed independent of one another it would not be nearly as frightening from a labor demand perspective. But they don't: they're all part of one gigantic dynamic mesh. This mesh will demand an unprecedented level of talent that will place a stunning labor strain on employers regardless of whether they are developing, supporting, or consuming these pervasive groundbreaking technologies.

On top of all this, when (or whether) they will continue to invest in them based on the global recession. We'll know more as the months pass but we don't expect any return to 'normalcy' until well into 2022.

And here's the rub: employers cannot aspire to capitalize on these transformation technologies without first climbing out of the deep hole they've been digging for years. That means perfecting HR practices that lack the power, agility and flexibility necessary to do competitive combat in a labor environment substantially different than what has existed heretofore.

There is a window of opportunity right now while these new technologies are maturing. More employers are commencing the serious work of repairing broken or underperforming people management systems and practices.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

### **LABOR FORECAST: Architecture to the rescue—but this time for managing tech professionals**

Foote Partners has worked with countless employers over more than 25 years in rethinking how they define the work of their tech professionals and shape an enterprise tech workforce to deliver on tech-driven business goals. But even more important, how they need to think about and build capabilities for the future, executing on business strategies that are not yet fully formed but which we, as experienced forecasters and analysts, have helped them understand capabilities they will need to be operational in their future.

Our conclusion is that the only approach to this particular work that has ever achieved *consistent* success — much less any proven success at all --- has been one based on a strong architectural foundation. Not business architecture or technical architecture but rather people architecture.

By this we mean applying, to human capital management, traditional architecture principles and practices. Adopting a framework for tech people and pay that properly defines, classifies, and aligns job roles, levels, skills and competencies across the enterprise and allows for accurate matching of people and jobs to a constantly evolving marketplace. And perhaps most importantly, one that is flexible in principle and agile enough in practice to enable job and pay scalability, meet forecasted labor needs, and accommodate growth and change with minimal pressure while also not creating new problems as a by-product.

**Tech People Architecture (TPA)** is similar in principle to traditional IT architecture initiatives but applied instead to workforce management and tech human capital. There are strategy and capability roadmaps, phase gate blueprints, benchmarks, performance metrics, and stakeholder management is critical. Governance issues need careful attention and business strategy drives it all. *Agile Compensation* is the answer to the chaos created by the proliferation of technology related job titles and lack of consistency in job definition and pay programs across the enterprise for the same work performed.

(For a detailed explanation of Tech People Architecture see: [WorldatWorld Journal - November/December 2019 issue](#))

But with Agile Compensation and Tech People Architecture it's about how key human capital management (HCM) elements such as job definition and design, skills demand and acquisition, compensation, incentives and recognition, professional development, and work/life balance plug into an overall optimized operational model. The model is tuned to new technologies, business strategy, organizational goals, and culture and performance philosophies and---because most of these are in constant flux---it promotes flexibility and scalability, like any disciplined architecture approach.

**Popularity of Tech People Architecture and Agile Compensation practices.** Clearly the widespread acceptance of technology's singular role as an engine of innovation and competitiveness is unquestioned. But so is the energized role thrust upon technology professionals and organizations to monetize technology.

With this, senior business management has held both tech leadership and business line leaders increasingly more accountable for managing the technology talent deployed to architect, build, and secure new products and services that are largely technology driven. Their performance for delivering higher levels of information and tech management has been more closely scrutinized. Examples include advanced analytics (for making more informed decisions), greater security (against dreaded cyber-attacks), and capitalizing on fast moving trends such as artificial intelligence/machine learning and digital innovation. Meanwhile, for the CIO, the imperative to streamline operations, reduce costs in every possible manner, and ensure compliance with countless regulations must still be met.

## TECH LABOR TRENDS DISCUSSION & ANALYSIS – cont'd.

Taken together, this has placed tremendous pressure on tech leadership to execute flawlessly and predictably in unfamiliar areas. For many employers this can only be achieved with a dramatic transformation of the tech workforce to a more appropriately skilled group of professionals who are capable of a level of agility, flexibility and aptitude not commonly associated with their predecessors. Companies must be able to architect their human capital to meet business needs now and especially in the future.

The cost of not being able to meet these high-performance bars is more difficulty finding, developing and retaining tech talent that can perform at a high caliber on increasingly more difficult tasks. TPA approaches enable employers to cope with the complexity of defining, determining pay, and laying out career paths for complex jobs at a time when recruiters are picking off your best people in the pandemic 'haze'.

Technology People Architecture and Agile Compensation focus on how key human capital management (HCM) elements such as job definition and design, skills demand and acquisition, compensation, incentives and recognition, professional development, and work/life balance plug into an overall optimized operational model. The model is tuned to new technologies, shifting business strategy and organizational imperatives, culture, and performance philosophies.

Together they propel flexibility and scalability, like any disciplined architecture approach. *This is exactly what has been missing for decades in the HR functions at many employers, resulting in constant labor gaps, skills deficits, and failure to execute consistently.*

For employers, Agile Compensation and Tech People Architecture has solved these problems:

- Reducing by 50% to 70% the number of tech-related job titles used to plan and administer pay — without changing the actual job titles bestowed on tech workers.
- Reducing tech staff churn in key roles, especially the most experienced tech workers
- Streamlining and simplifying compensation administration, giving employers the capacity to classify and market price any job, no matter how unique it is.
- Reducing uncertainty about how much to pay tech professionals, especially new jobs and the “Swiss Army knife” hybrid positions..
- Reducing job definition/design chaos around tech jobs that don't fit in with established tech roles.
- Increasing consistent availability and quality of skills and workers and achieving higher utilization rates.

Why has **Tech People Architecture** become the most successful alternative for most employers? Because architecture practices are familiar to technology executives. Technical architecture practices have been successful for decades because, when done well, companies have achieved an understanding of what they have systems-wise and could then connect it to where they were going and how they were going to get there, all within a process inclusive of all the various stakeholders who shared the risk in the outcome. TPA achieves the same results, except for shaping the tech workforce for both current and future requirements.

## IT Skills & Certifications Pay Data Trend Charts & Analysis

### IT Skills and Certifications Pay Index™ – 3rd Quarter 2020 data edition

(Data collected through October 1, 2020)

- **IT Certifications** (Page 33)
- **Noncertified IT Skills** (Page 47)
- **IT Skills & Certifications Volatility Index™** (Page 60)

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### ***How to interpret gains and losses in IT skills and certifications pay premiums***

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Quarterly gains and losses in premium pay reflect a widening or narrowing, respectively, in the gap between supply and demand for skills and certifications. This may occur for any number of reasons. For example, a quarterly decline in pay for a skill may signal that the market supply of talent for that skill is catching up to demand—not necessarily that demand is starting to wane. IT professionals are often attracted to a skill or certification if they perceive that it has rising value in the marketplace and therefore can help them to achieve higher pay, greater job security, a promotion, or more flexibility in their career choices. As they pursue greater competency in that skill or as more workers attain certification, supply increases and market pricing (which is elastic to the laws of supply and demand) will be driven downward unless demand is rising at the same proportional rate. Conversely, if demand rises and supply is not increasing to match that level of demand, pay premiums for specific skills and certifications will increase.

Therefore, when interpreting gains and losses in market pay it is important to consider all factors that could be driving supply and demand and market perception. Those factors range from:

- aggressive marketing of certifications by vendors;
- changes in certification programs (e.g. certification extensions or retirement);
- new technology and evolution/maturation of current technologies;
- technology adoption rate;
- product integration strategies,
- economic conditions;
- employment opportunities;
- mergers/acquisitions;
- budget cycles and the timing of skills and talent acquisition by employers;
- changes in labor sourcing plans pursuant to company strategies.

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## IT Certifications: Pandemic winners

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(Data collected through October 1, 2020)



**Cash pay premiums are reported for these IT certifications (516)**

Avaya Certified Design Specialist  
 Avaya Certified Implementation Specialist  
 Avaya Certified Integration Specialist  
 Avaya Certified Solution Specialist  
 Avaya Professional Design Specialist  
 AWS Certified Developer - Associate  
 AWS Certified DevOps Engineer - Professional  
 AWS Certified Solutions Architect - Associate (Cloud)  
 AWS Certified Solutions Architect - Professional (Cloud)  
 AWS Certified SysOpsAdministrator-Associate (Cloud)  
 BICSI ITS Technician  
 BICSI Technician and Registered Communications Distribution Designer  
 Brocade Certified Network Engineer  
 Brocade Certified Network Professional  
 Brocade Certified Fabric Designer  
 Brocade Certified Fabric Professional (BCFP)  
 Certificate of Cloud Security Knowledge  
 Certification Authorization Professional (CAP)  
 Certification of Capability in Business Analysis (CCBA)  
 Certified Analytics Professional (CAP)  
 Certified Business Analysis Professional (CBAP)  
 Certified Business Continuity Professional (CBCP)  
 Certified Cloud Architect  
 Certified Cloud Security Professional (CCSP)  
 Certified Cloud Technology Professional  
 Certified Computer Examiner (CCE)  
 Certified Computing Professional (CCP-ISC2)  
 Certified Cyber Forensics Professional  
 Certified Data Centre Management Professional (CDCMP)  
 Certified Data Management Professional (CDMP)  
 Certified Disaster Recovery Engineer (C/DRE)  
 Certified Forensic Computer Examiner (CFCE)  
 Certified Fraud Examiner  
 Certified Healthcare Information Security and Privacy Practitioner (HCISPP)  
 Certified in Convergent Network Technologies (CCNT)  
 Certified in Governance, Risk and Compliance  
 Certified in Risk and Information Systems Control (CRISC)  
 Certified in the Governance of Enterprise IT (CGEIT)  
 Certified Information Privacy Manager- all countries  
 Certified Information Privacy Professional - all countries  
 Certified Information Privacy Technologist- all countries  
 Certified Information Security Manager (CISM)  
 Certified Information Systems Auditor (CISA)

Certified Information Systems Security Professional (CISSP)  
 Certified IP Telecom Network Specialist (CIPTS)  
 Certified Telecom Network Specialist (CIPTS)  
 Certified IT Architect (IASA CITA)  
 Certified IT Compliance Professional  
 Certified Manager of Software Quality (CMSQ)  
 Certified Penetration Testing Engineer (CPTe)  
 Certified Project Management Practitioner  
 Certified Protection Professional  
 Certified ScrumMaster  
 Certified Scrum Coach  
 Certified Scrum Developer  
 Certified Scrum Product Owner  
 Certified Scrum Professional  
 Certified Scrum Trainer  
 Certified Secure Software Lifecycle Professional (CSSLP)  
 Certified Software Quality Analyst (CSQA)  
 Certified Telecommunications Network Specialist (CTNS)  
 Check Point Certified Security Administrator (CCSA)  
 Check Point Certified Security Expert (CCSE)  
 Check Point Certified Security Master (CCSM)  
 Cisco Certified Architect  
 Cisco Certified CyberOps Associate  
 Cisco Certified Design Expert (CCDE)  
 Cisco Certified DevNet Associate  
 Cisco Certified DevNet Professional  
 Cisco Certified Entry Network Technician (CENT)  
 Cisco Certified Internetwork Expert (CCIE, all variations)  
 Cisco Certified Network Associate - Data Center  
 Cisco Certified Network Associate (CCNA Routing and Switching)  
 Cisco Certified Network Associate (was CCNA Cloud)  
 Cisco Certified Network Associate (was CCNA Collaboration)  
 Cisco Certified Network Associate (was CCNA Wireless)  
 Cisco Certified Network Associate (was Design Associate)  
 Cisco Certified Network Professional - Collaboration  
 Cisco Certified Network Professional - Data Center  
 Cisco Certified Network Professional - Data Center (CCNP Cloud)  
 Cisco Certified Network Professional - Enterprise (was CCNP Routing and Switching)  
 Cisco Certified Network Professional - Enterprise (was CCNP Wireless)

Cisco Certified Network Professional - Security  
 Cisco Certified Network Professional (CCNP)  
 Cisco Certified Network Professional (was CC Design Professional)  
 Cisco Certified Systems Instructor (CCSI)  
 Cisco Data Center Unified Computing Design Specialist  
 Cisco Data Center Unified Fabric Support Specialist  
 Citrix Certified Associate - Networking (CCA)  
 Citrix Certified Associate – Virtualization  
 Citrix Certified Expert - Networking  
 Citrix Certified Expert - Virtualization  
 Citrix Certified Instructor (CCI - Virtualization, Networking, or Mobility)  
 Citrix Certified Professional - Networking  
 Citrix Certified Professional-Virtualization (CCP-V)  
 Citrix XenServer Certified (CC-XenServer)  
 CIW Certified Database Design Specialist  
 CIW Web Design Professional  
 CIW Web Development Professional  
 CIW Web Foundations Associate  
 CIW Web Security Professional  
 Cloud U (Rackspace)  
 Cloudera Certified Associate Administrator  
 Cloudera Certified Associate Data Analyst  
 Cloudera Certified Associate Spark and Hadoop Developer  
 Cloudera Certified Professional: Data Engineer  
 CompTIA A+  
 CompTIA Advanced Security Practitioner  
 CompTIA Certified Technical Trainer  
 CompTIA Cloud Essentials  
 CompTIA Cloud+  
 CompTIA Cybersecurity Analyst+  
 CompTIA Linux+  
 CompTIA Mobile App Security+  
 CompTIA Mobility+  
 CompTIA Network (Network+)  
 CompTIA Penetration Tester  
 CompTIA Project+  
 CompTIA Security+  
 CompTIA Server+  
 CompTIA Storage+  
 Convergence Technologies Professional (CTP)  
 CSX CyberSecurity Practitioner (CSXP)  
 CWNP Certified Wireless Security Professional (CWSP)  
 CWNP/Certified Wireless Analysis Professional (CWAP)  
 CWNP/Certified Wireless Design Professional (CWDP)  
 CWNP/Certified Wireless Network Administrator (CWNA)  
 CWNP/Certified Wireless Network Trainer (CWNT)  
 CWNP/Certified Wireless Technology Specialist (CWTS)

CWNP/Certified Wireless Network Expert (CWNE)  
 CWNP Security Forensic Analyst  
 EC-Council Certified Application Security Engineer (CASE)  
 EC-Council Certified Encryption Specialist (ECES)  
 EC-Council Certified Ethical Hacker (CEH)  
 EC-Council Certified Incident Handler V2 (ECIH)  
 EC-Council Certified Network Defender  
 EC-Council Certified Network Defense Architect (CNDA)  
 EC-Council Certified Security Analyst (ECSA)  
 EC-Council Computer Hacking Forensic Investigator (CHFI)  
 EC-Council Disaster Recovery Professional (EDRP)  
 EC-Council Licensed Penetration Tester (LPT)  
 EMC Cloud Architect Expert  
 EMC Cloud Architect Specialist  
 EMC Cloud Engineer (EMCCE)  
 EMC Data Center Architect (EMCDCA - all versions)  
 EMC Data Science Associate  
 EMC Data Science Specialist, Advanced Analytics  
 EMC Implementation Engineer - Expert (EMCIE)  
 EMC Implementation Engineer - Specialist (EMCIE)  
 EMC Information Storage Associate (EMCISA)  
 EMC Platform Engineer - Specialist (EMCPE)  
 EMC Storage Administrator - Associate (EMCSA-A)  
 EMC Storage Administrator - Expert (EMCSA-E)  
 EMC Storage Administrator - Specialist (EMCSA-S)  
 EMC System Administrator – Documentum Specialist (EMCSyA)  
 EMC Technology Architect - Expert (EMCTA)  
 EMC Technology Architect - Specialist (EMCTA)  
 GIAC Assessing Wireless Networks  
 GIAC Certified Defending Advanced Threats (GDAT)  
 GIAC Certified Detection Analyst (GCDA)  
 GIAC Certified Enterprise Defender (GCED)  
 GIAC Certified Forensics Analyst (GCFA)  
 GIAC Certified Forensics Examiner  
 GIAC Certified Incident Handler (GCIH)  
 GIAC Certified Intrusion Analyst (GCIa)  
 GIAC Certified Penetration Tester (GPEN)  
 GIAC Certified Perimeter Protection Analyst (GPPA)  
 GIAC Certified Project Manager (GCPM)  
 GIAC Certified Unix Security Administrator (GCUX)  
 GIAC Certified Web Application Defender  
 GIAC Certified Windows Security Administrator (GCWN)  
 GIAC Critical Controls Certifications (GCCC)  
 GIAC Cyber Threat Intelligence (GCTI)

GIAC Exploit Researcher and Advanced Penetration Tester  
 GIAC Information Security Fundamentals (GISF)  
 GIAC Information Security Professional (GISP)  
 GIAC Mobile Device Security Analyst (GMOB)  
 GIAC Network Forensic Analyst (GNFA)  
 GIAC Python Coder (GPYC)  
 GIAC Reverse Engineering Malware (GREM)  
 GIAC Secure Software Programmer--Java  
 GIAC Secure Software Programmer--.NET  
 GIAC Security Essentials (GSEC)  
 GIAC Security Expert (GSE)  
 GIAC Security Leadership (GSLC)  
 GIAC Systems and Network Auditor (GSNA)  
 GIAC Web Application Penetration Tester (GWAPT)  
 Google Associate Cloud Engineer  
 Google Certified Professional Cloud Architect  
 Google Cloud Certified - Professional Data Engineer  
 Google Professional Cloud Developer  
 Google Professional Cloud Network Engineer  
 Google Professional Cloud Security Engineer  
 HDI Customer Service Representative  
 HDI Desktop Support Manager  
 HDI Desktop Support Technician  
 HDI Support Center Analyst  
 HDI Support Center Director  
 HDI Support Center Manager  
 HDI Support Center Team Lead  
 HDI Technical Support Professional  
 Help Desk Analyst: Tier 1 Support Specialist/Ed2Go  
 Help Desk Team Lead/RCCSP  
 Hitachi Qualified Professional - Storage Administration  
 HP Accredited Integration Specialist (AIS)  
 HP Accredited Solutions Expert (ASE - all)  
 HP Accredited Technical Professional (ATP - all)  
 HP ASE - Cloud Architect V2  
 HP ASE – Cloud Integrator V2  
 HP ASE - Storage Solutions Architect V1 /V2  
 HP ASE - Vertica Big Data Solutions Administrator V1  
 HP ATP - Cloud Administrator V1  
 HP ATP - Storage Solutions V1 /V2  
 HP ATP Big Data Vertica Solutions V1  
 HP Master Accredited Solutions Expert (MASE - all)  
 Huawei Certified Network Associate (all)  
 Huawei Certified Network Professional (all)  
 Huawei Certified Network Expert (all)  
 IBM Advanced Systems Administrator (all)  
 IBM Certified Administrator - Cognos  
 IBM Certified Advanced Application Developer (all)  
 IBM Certified Application Developer (all)

IBM Certified Data Engineer - Big Data  
 IBM Certified Database Administrator - DB2  
 IBM Certified Designer - Cognos BI  
 IBM Certified Developer - Cognos  
 IBM Certified Solution Advisor - Cloud Computing Architecture V5  
 IBM Certified Solution Advisor - DevOps V2  
 IBM Certified Solution Architect – Cloud Computing Infrastructure V1  
 IBM Certified Solution Designer (all)  
 IBM Certified Solution Developer - DB2 SQL  
 IBM Certified Solution Developer: WebSphere (all)  
 IBM Certified Specialist - z System (all)  
 IBM Certified Specialist - Virtualized Storage V1  
 IBM Certified Administrator: WebSphere DataPower SOA  
 IBM Certified Systems Administrator - AIX V1  
 IBM Certified Systems Administrator - WebSphere AS  
 IBM Certified Systems Administrator (all)  
 InfoSys Security Architecture Professional (ISSAP/CISSP)  
 InfoSys Security Engineering Professional (ISSEP/CISSP)  
 InfoSys Security Management Professional (ISSMP/CISSP)  
 ITIL Expert Certification  
 ITIL Foundation Certification  
 ITIL Intermediate Certification  
 ITIL Master Certification  
 JBoss Certified Developer (Seam, Persistence, ESB)  
 Juniper Networks Certified Internet Associate  
 Juniper Networks Certified Internet Expert  
 Juniper Networks Certified Internet Professional  
 Juniper Networks Certified Internet Specialist  
 Linux Professional Institute certification (LPIC- 2)  
 Linux Professional Institute certification (LPIC- 3)  
 Magento 2 Certified Professional Developer  
 MCSE: Core Infrastructure  
 Microsoft Certified Azure Data Engineer Associate  
 Microsoft Certified Azure Data Scientist Associate  
 Microsoft Certified: Azure AI Engineer Associate  
 Microsoft Certified: Azure Security Engineer Associate  
 Microsoft Certified Professional  
 Microsoft Certified Solutions Associate(all)  
 Microsoft Certified Solutions Associate: BI Reporting  
 Microsoft Certified Solutions Associate: Cloud Platform

Microsoft Certified Solutions Associate: Microsoft Dynamics 365  
 Microsoft Certified Solutions Associate: SQL 2016 DBA  
 Microsoft Certified Solutions Associate: SQL Server 2012/2014/2016  
 Microsoft Certified Solutions Associate: Web Applications  
 Microsoft Certified Solutions Associate: Windows Server 2012/2016  
 Microsoft Certified Solutions Developer (MCSRD)  
 Microsoft Certified Solutions Developer: Applications Builder  
 Microsoft Certified Solutions Expert : Server Infrastructure  
 Microsoft Certified Solutions Expert: Business Applications  
 Microsoft Certified Solutions Expert: Business Intelligence  
 Microsoft Certified Solutions Expert: Cloud Platform and Infrastructure  
 Microsoft Certified Solutions Expert: Data Management and Analytics  
 Microsoft Certified Solutions Expert: Data Platform  
 Microsoft Certified Solutions Expert: Desktop Infrastructure  
 Microsoft Certified Trainer (MCT)  
 Microsoft Certified: Azure Administrator Associate  
 Microsoft MTA: Windows OS  
 Microsoft Office Specialist  
 Mongo DB Certified DBA  
 Mongo DB Certified Developer  
 MongoDB Certified Developer Associate  
 NetApp Certified Data Administrator, ONTAP (NCDA)  
 NetApp Certified Implementation Engineer (NCIE)  
 NetApp Certified Storage Associates – Hybrid Cloud  
 NetScout/nGenius Certified Analyst (nCA)  
 NetScout/nGenius Certified Expert (nCE)  
 NetScout/nGenius Certified Master (nCM)  
 NetScout/nGenius Certified Professional (nCP)  
 Novell/Certified Administrator (CNA)  
 Novell/Certified Novell Engineer (CNE)  
 Novell Certified Instructor  
 Novell Certified Linux Engineer (Novell CLE)  
 Novell Certified Linux Professional (Novell CLP)  
 Novell Identity Manager Administrator  
 Open Group Certified Architect (Open CA)  
 Open Group Certified IT Specialist (Open CITS)  
 Oracle Business Intelligence Foundation Suite 11G Certified Implementation Specialist  
 Oracle Certified Associate - DBA (OCA)  
 Oracle Certified Associate - Java SE Programmer  
 Oracle Certified Associate - MySQL 5  
 Oracle Certified Associate - WebLogic Server Administrator  
 Oracle Certified Expert - Java Platform EE Developer (all)  
 Oracle Certified Expert - MySQL 5.1 Cluster Database Administrator

Oracle Certified Expert - Siebel CRM Business Analyst  
 Oracle Certified Expert - Solaris 10 Network Administrator for Solaris  
 Oracle Certified Master - DBA (OCM)  
 Oracle Certified Master - Java EE Enterprise Architect  
 Oracle Certified Master - Java SE Developer  
 Oracle Certified Professional - Advanced PL/SQL Developer  
 Oracle Certified Professional - Application Server Administrator  
 Oracle Certified Professional - Database Cloud Administrator  
 Oracle Certified Professional - DBA (OCP)  
 Oracle Certified Professional - E-Business Suite 12  
 Oracle Certified Professional - Fusion Middleware 11g Forms Developer  
 Oracle Certified Professional - Java EE Web Services Developer  
 Oracle Certified Professional - Java SE Programmer  
 Oracle Certified Professional - MySQL 5 Database Administrator  
 Oracle Certified Professional - MySQL 5 Developer  
 Oracle Certified Professional - PL/SQL Developer  
 Oracle Certified Professional - Solaris 10 Systems Administrator  
 Oracle Certified Professional, Java EE Web Component Developer  
 Oracle Certified WebLogic Server System Administrator Certified Expert  
 Oracle Exadata 11g Certified Implementation Specialist  
 Oracle Linux Certified Administrator (OCA)  
 Oracle SOA 12c Infrastructure Implementation Certified Expert  
 Oracle VM 3.0 for x86 Certified Implementation Specialist  
 Pegasystems Certified Lead System Architect  
 Pegasystems Certified Senior Systems Architect  
 Pegasystems Certified System Architect  
 Pegasystems Certified Pega Business Architect  
 Pegasystems Certified UI Specialist  
 PHP Certification  
 Pivotal Application Architect  
 Pivotal Cloud Foundry Operator certification  
 Pivotal Developer  
 PMI Agile Certified Practitioner (PMI-ACP)  
 PMI Certified Associate in Project Management (CAPM)  
 PMI Portfolio Management Professional (PfMP)  
 PMI Professional in Business Analysis (PMI-PBA)  
 PMI Program Management Professional (PgMP)

PMI Project Management Professional(PMP)  
 PMI Risk Management Professional (PMI-RMP)  
 Prince2 Foundation  
 Prince2 Practitioner  
 Professional Certified Investigator  
 Professional in Project Management (GAQM)  
 QlikView Business Analyst  
 QlikView Data Architect  
 Qualified Information Security Professional Q/ISP  
 Rackspace Certified Technician  
 Red Hat Certified Architect (RHCA)  
 Red Hat Certified Architect: Application Development  
 Red Hat Certified Architect: Application Platform  
 Red Hat Certified Architect: Cloud  
 Red Hat Certified Architect: DevOps  
 Red Hat Certified Datacenter Specialist (RHCD)  
 Red Hat Certified Engineer in Red Hat OpenStack  
 Red Hat Certified Engineer(RHCE)  
 Red Hat Certified System Administrator in Red Hat OpenStack  
 Red Hat Certified Systems Administrator (RHCSA)  
 RedHat Certified Specialist in Virtualization  
 RSA Certified Administrator (RSA/CA)  
 RSA Certified Instructor (RSA/CI)  
 Salesforce Certified Administrator  
 Salesforce Certified Advanced Administrator  
 Salesforce Certified Application Architect  
 Salesforce Certified Data Architecture and Management Designer  
 Salesforce Certified Mobile Solutions Architecture Designer  
 Salesforce Certified Platform Developer  
 Salesforce Certified Systems Architect  
 Salesforce Certified Technical Architect  
 Salesforce Commerce Cloud Digital Developer  
 Salesforce Platform App Builder  
 SAS Certified Advanced Programmer for SAS 9  
 SAS Certified Base Programmer for SAS 9  
 SAS Certified Big Data Professional Using SAS 9  
 SAS Certified Data Integration Developer for SAS 9  
 SAS Certified Data Scientist Using SAS 9  
 SAS Certified Predictive Modeler - SAS Enterprise Miner 14  
 SAS Certified Statistical Business Analyst - SAS 9  
 SAS® Certified Advanced Analytics Professional Using SAS®9  
 SAS® Certified BI Content Developer for SAS®9  
 SAS® Certified Data Quality Steward for SAS®  
 Siebel 8 Consultant Certified Expert  
 Six Sigma Black Belt  
 Six Sigma Green Belt  
 Six Sigma Master Black Belt  
 Six Sigma Yellow Belt

SNIA Certified Storage Architect  
 SNIA Certified Storage Networking Expert (SCSN-E)  
 SNIA Certified Storage Professional  
 SNIA Certified Systems Engineer Sniffer Certified Expert  
 SolarWinds Certified Professional (SCP)  
 SUSE Certified Administrator  
 SUSE Enterprise Engineer (SCE)  
 SUSE Enterprise Architect or (SEA)  
 Systems Security Certified Practitioner (SSCP)  
 Teradata 14 Certified Associate  
 Teradata 14 Certified Database Administrator  
 Teradata 14 Certified Enterprise Architect  
 Teradata 14 Certified Master  
 Teradata 14 Certified Professional  
 Teradata 14 Certified Solutions Developer  
 Teradata 14 Certified Technical Specialist  
 TIBCO Certified Professional  
 TIBCO Certified SOA Architect  
 TOGAF 9 Certified  
 VMware Certified Advanced Professional 6.5 - Data Center Virtualization Design  
 VMware Certified Advanced Professional – Network Virtualization  
 VMware Certified Advanced Professional (all)  
 VMware Certified Advanced Professional 6 - Data Center Virtualization Deployment  
 VMware Certified Advanced Professional 6/7 - Cloud Mgt and Automation Deployment  
 VMware Certified Advanced Professional 6/7 - Cloud Mgt and Automation Design  
 VMware Certified Associate - Cloud  
 VMware Certified Associate - Data Center Virtualization  
 VMware Certified Design Expert – Network Virtualization  
 VMware Certified Design Expert - Cloud Mgt and Automation  
 VMware Certified Design Expert (all)  
 VMware Certified Design Expert – Network Virtualization  
 VMware Certified Design Expert - Cloud Mgt and Automation  
 VMware Certified Design Expert (all)  
 VMware Certified Design Expert 6 - Data Center Virtualization  
 VMware Certified Professional - Digital Workspace  
 VMware Certified Professional – Desktop and Mobility 2019

Mware Certified Professional 6/7 - Cloud Mgt and Automation  
 VMware Certified Professional - Network Virtualization  
 VMware Certified Professional 6 - Data Center Virtualization (VCP6-DCV)  
 VMware Certified Professional 6.5 - Data Center Virtualization (VCP6.5-DCV)  
 VMware Certified Professional 6/6.5  
 VMware Certified

## CERTIFICATION ANALYSIS – Pandemic Winners

### A. TECH CERTIFICATIONS CURRENTLY EARNING WELL ABOVE-AVERAGE PAY AND STILL GAINING IN CASH MARKET VALUE

The average market value for 516 tech certifications **decreased 1.5 percent overall in the third quarter of 2020**, the ninth consecutive calendar quarter of losses that total nearly 11 percent over the same period. Pay premiums for single certifications are averaging the equivalent of 6.8% of base salary in October 2020.

#### ***Why have more certifications been losing value than gaining value?***

Certifications decline in market value for a number of obvious and not so obvious reasons. Pay premiums may diminish as a certification expires, is retired, or is replaced with more appropriate certifications as technology evolves. Also, there remains a lingering bias that taking a proctored exam does not confer expertise in a subject on the test taker, especially when the pass rate is 70 percent correct answers. The certification industry has fought back against this bias by adding laboratory requirements and even peer review panels that decide if the candidate has qualified to receive designation.

But just as often it's their popularity that drives down pay premiums for a certification: as interest in a certification escalates and more people attain the certification the gap between supply and demand for the certification narrows, driving down its market value as the laws of scarcity would dictate. This has been documented in the case of dozens of certifications over the 20 years Foote Partners has been tracking and reporting their cash pay premiums in the ***IT Skills and Certifications Pay Index***.

\* \* \*

***Which certifications are bucking the trend---highest paying and still growing in value?*** The following tech certifications are distinctive for two reasons:

- They recorded notable gains in cash market value in the **six months ending October 1, 2020**
- They are also earning cash pay premiums significantly higher than the average of all 516 certifications being reported.

It's a dwindling list this data edition: only seven certifications qualified this time versus fifteen certifications just three months ago.

## CERTIFICATION ANALYSIS - cont'd.

### 1. **CompTIA Advanced Security Practitioner (CASP+)**

*Average Pay Premium: 14 percent* of base salary equivalent

*Market Value Increase: 7.7 percent* (in the six months through October 1, 2020)

The **Advanced Security Practitioner** from CompTIA is the only hands-on, performance-based certification for practitioners — not managers — at the advanced skill level of cybersecurity. While cybersecurity managers help identify what cybersecurity policies and frameworks could be implemented, CASP+ certified professionals figure out how to implement solutions within those policies and frameworks. This certification validates advanced-level competency in risk management, enterprise security operations and architecture, research and collaboration, and integration of enterprise security. It measures knowledge in the following:

- Enterprise security domain expanded to include operations and architecture concepts, techniques and requirements
- More emphasis on analyzing risk through interpreting trend data and anticipating cyberdefense needs to meet business goals
- Expanding security control topics to include mobile and small-form factor devices, as well as software vulnerability
- Broader coverage of integrating cloud and virtualization technologies into a secure enterprise architecture
- Inclusion of implementing cryptographic techniques, such as blockchain, cryptocurrency and mobile device encryption

### 2. **GIAC Exploit Researcher and Advanced Penetration Tester (GXPN)**

*Average Pay Premium: 12 percent* of base salary equivalent

*Market Value Increase: 20 percent* (in the six months through October 1, 2020)

A white hat hacker, or ethical hacker, uses penetration testing techniques to test an organization's IT security and to identify vulnerabilities. IT security staff then uses the results of such penetration tests to remediate vulnerabilities, strengthen security and lower an organization's risk factors. Penetration testing is never a casual undertaking; it involves lots of planning, which includes getting explicit permission from management to perform tests, and then running tests as safely as possible. These tests often involve the very same techniques that attackers use to breach a network for real.

White hat hacking involves a great deal of problem solving, as well as communication skills. A white hat hacker also requires a balance of intelligence and common sense, strong technical and organizational skills, impeccable judgement and the ability to remain cool under pressure.

At the same time, a white hat needs to think like a black hat hacker, with all their nefarious goals and devious skills and behavior. Some top-rate white hat hackers are former black hat hackers who got caught, and for various reasons decided to leave a life of crime behind and put their skills to work in a positive (and legal) way. There are no standard education criteria for a white hat hacker — every organization can impose its own requirements on that position — but a bachelor's or master's degree in information security, computer science or even mathematics provides a strong foundation. For those who aren't college bound, a military background, especially in intelligence, can help your resume get noticed by hiring managers. Military service is also a plus for employers who require or prefer those with security clearances.

The **GIAC Exploit Researcher and Advanced Penetration Tester** certification targets security personnel whose job duties involve assessing target networks, systems and applications to find vulnerabilities. The GXPN certifies that candidates have the knowledge, skills, and ability to conduct advanced penetration tests, model the behavior of attackers to improve system security, and the knowledge to demonstrate the business risk associated with these behaviors.

## CERTIFICATION ANALYSIS - cont'd.

### 3. Certified in the Governance of Enterprise IT (CGEIT)

*Average Pay Premium:* 11 percent of base salary equivalent

*Market Value Increase:* 37.5 percent (in the six months through October 1, 2020)

With 6,100 having achieved the **Certified in the Governance of Enterprise IT (CGEIT)** certification from ISACA as of August 2020 and an 11 percent growth rate over the past two years, tech professionals who have achieved this vendor-neutral certification hold senior-level positions in their organizations. The CGEIT is designed for professionals who are deeply entrenched in enterprise governance and assurance—two areas that were growing in popularity before the pandemic and having only increased with the chaos it has created. They know how to align business with IT, follow best practices and standards for IT operations and governance, manage IT investments, and foster environments that continuously improve on processes and policies.

The CGEIT exam has five domains:

- Domain 1: IT governance framework (25 percent)
- Domain 2: Strategic management (20 percent)
- Domain 3: Benefits realization (16 percent)
- Domain 4: Risk optimization (24 percent)
- Domain 5: Resource optimization (15 percent)

*Domain 1* includes establishing a framework for governance of enterprise IT that helps the organization realize its goals and objectives, while considering risk and optimization. It also covers all the basic requirements, policies, principles, processes, organizational structures, infrastructure, skills and competencies necessary to build, oversee, and manage a framework IT governance.

*Domain 2* focuses on aligning IT with enterprise objectives creating a strategic plan that helps the organization understand how changes to business strategy will impact IT strategy. This domain covers knowledge of IT roles and responsibilities, prioritization processes, documentation and communication methods, potential barriers for strategic alignment and current and future technologies.

*Domain 3* covers benefits realization, which is the process of managing, tracking and reporting on the performance of IT investments to ensure they deliver optimized business benefits. This domain includes knowledge of KPIs, benefit calculation techniques, how to measure and monitor outcome and performance, and knowledge of continuous improvement concepts and principles.

*Domain 4* encompasses risk optimization, which is the process of ensuring IT risk management frameworks help identify, analyze, mitigate, manage, monitor and communicate IT-related business risk and that they're aligned with the enterprise risk management (ERM) framework. Risk optimization also includes an understanding of appropriate legal and compliance regulations and the ability to communicate risk to senior-level executives. You'll need knowledge of disaster recovery planning (DRP), business continuity planning (BCP), standard risk management frameworks, key risk indicators (KRIs) and the skills to report on analytical data.

## CERTIFICATION ANALYSIS - cont'd.

*Domain 5* covers the optimization of IT resources, including information, services, infrastructure and applications, and people. This domain includes everything you need to know to ensure the correct processes are in place to reach enterprise goals. You'll need knowledge of IT resource management, service level agreements (SLAs), operation level agreements (OLAs) and data management and data governance.

To achieve CGEIT certification, candidates must pass a 150-question exam and provide proof of work experience (a minimum of five years of professional-level enterprise management, or serving in an advisory or governance support role). The work experience requirement for the CGEIT is more specific than for other ISACA certifications. One year of experience must be related to enterprise IT governance frameworks, and the other years must be related to strategic management, benefits realization, risk optimization or resource optimization (pick two).

### 4. [Tie] Certified Scrum Product Owner

#### GIAC Information Security Professional (GISP)

*Average Pay Premium:* 11 percent of base salary equivalent

*Market Value Increase:* 22.2 percent (in the six months through July 1, 2020)

From a business standpoint, one of the most vital roles on any Scrum team is the Product Owner (PO). It is a challenging role, one that requires the PO to take accountability for making business decisions about the product—decisions such as which features to include and the priority of those features. However, these decisions cannot be made in a vacuum. Because the PO must get input from other business stakeholders, they need skills such as facilitation, conflict management, creative thinking, and the ability to influence the team and other stakeholders.

While the Certified ScrumMaster helps the Scrum Team work together to learn and implement Scrum, the **Certified Scrum Product Owner (CSPO)** creates the product vision; writes or participates in the writing of product requirements; develops and prioritizes the list of these features called a product backlog; review, test and accept the product; and make sure the best possible job is done to satisfy the customer. To achieve this certification, the candidate attends a live online or in-person course taught by a Certified Scrum Trainer® (CST®), or receives private coaching from a Certified Agile Coach (CAC). After successfully completing the course, you will be asked to accept the CSPO License Agreement.

Benefits of a Certified Scrum Product Owner certification:

- Expand career opportunities across all industry sectors adopting Agile practices
- Demonstrate your attainment of core Scrum knowledge
- Learn the foundation of Scrum and the scope of the Product Owner role
- Engage with Agile practitioners committed to continuous improvement

The **GIAC Information Security Professional (GISP)** certification validates a practitioner's knowledge of the 8 domains of cybersecurity knowledge:

- Asset Security
- Communications and Network Security
- Identity and Access Management
- Security and Risk Management
- Security Assessment and Testing
- Security Engineering
- Security Operation
- Software Development Security

## CERTIFICATION ANALYSIS - cont'd.

GISP certification holders will be able to demonstrate knowledge of asset security, communications and network security, identity and access management, security and risk management, security assessment and testing, security engineering, security operation, and software development security. This certification is generally intended for those holding these kinds of jobs:

- Security Professionals who want to understand the concepts covered in the CISSP® exam as determined by (ISC)2
- System administrators
- Security administrators
- Network administrators
- Security managers

### 6. **Salesforce.com Certified Technical Architect**

*Average Pay Premium:* 10 percent of base salary equivalent

*Market Value Increase:* 11.1 percent (in the six months through October 1, 2020)

Salesforce.com is one of the top vendors of customer relationship management (CRM) products for all size companies but especially for small businesses. You'll find Salesforce products and services in use across a wide swath of industries, from automotive and healthcare, to nonprofits, retail, media and communications, and finance. Initially offered as sales automation software, Salesforce is now best known for its Intelligent Customer Success Platform, which provides cloud solutions for sales, communities, service, analytics, marketing, platform, apps, the internet of things (IoT) and artificial intelligence.

Among three architect certifications offered by Salesforce, at the top is the **Salesforce Certified Technical Architect**, the crème de la crème of the Salesforce architect portfolio. This pinnacle credential recognizes professionals who implement and design custom customer solutions on the Force.com platform, a more specialized platform as a service (PaaS) built specifically to integrate custom apps with Salesforce cloud offerings.

To obtain this designation, you must first earn the other two domain architecture credentials (Salesforce Certified Application Architect, Salesforce Certified System Architect). At that point, you're qualified to take the Salesforce Certified Technical Architect Certification Review Board Exam. During the exam, you will be provided with a hypothetical scenario, with detailed customer requirements, and be asked to present and justify your recommended architecture solution. Candidates must complete each task in order and may not move on to the next item until the prior task has been successfully completed.

### 7. **AWS Certified Solutions Architect - Professional**

*Average Pay Premium:* 9 percent of base salary equivalent

*Market Value Increase:* 12.5 percent (in the six months through October 1, 2020)

The **AWS Certified Solutions Architect – Professional** certification targets networking professionals with two or more years of hands-on experience designing and deploying cloud environments on AWS. A person with this credential works with clients to assess needs, plan and design solutions that meet requirements; recommends an architecture for implementing and provisioning AWS applications; and provides guidance throughout the life of the projects.



## CERTIFICATION ANALYSIS - cont'd.

Abilities validated by this certification:

- Design and deploy dynamically scalable, highly available, fault-tolerant, and reliable applications on AWS
- Select appropriate AWS services to design and deploy an application based on given requirements
- Migrate complex, multi-tier applications on AWS
- Design and deploy enterprise-wide scalable operations on AWS
- Implement cost-control strategies

**CERTIFICATION ANALYSIS - cont'd.**

**B. TECH CERTIFICATIONS LOSING THE MOST IN CASH MARKET VALUE**

In Figure 4 is a table showing **tech certifications currently recording the largest market value losses in the six months ending October 1, 2020**. In some cases, these declines can be attributed to a narrowing of the gap between supply and demand as more candidates achieve certification. However as stated earlier in this report, not all employers recognize certification to be an adequate measure of talent in a technology discipline, preferring alternative forms of accreditation to fit their needs.

Certifications are grouped by percentage declines, and within each group in alphabetical order.

<b>Certifications</b>	Pay Premium (as Equivalent % of Base Salary)	6-mo. Market Value Change (April - October 2020)
CompTIA Linux+	4%	-42.9%
Six Sigma Green Belt	6%	-35.0%
CIW Web Development Professional	2%	-33.3%
Juniper Networks Certified Internet Professional (JNCIP)	4%	-33.3%
PMI Certified Associate in Project Management (CAPM)	6%	-33.3%
Six Sigma Black Belt	8%	-33.3%
VMware Certified Design Expert - Cloud Mgt and Automation	6%	-33.3%
InfoSys Security Management Professional (ISSMP/CISSP)	7%	-30.0%
Linux Professional Institute certification (LPIC-Level 3)	5%	-28.6%
VMware Certified Advanced Professional (all)	5%	-28.6%
VMware Certified Advanced Professional 6 - Data Center Virtualization Deployment	5%	-28.6%
CIW Certified Database Design Specialist	3%	-25.0%
Microsoft Certified Trainer (MCT)	3%	-25.0%
SNIA Certified Storage Professional (SCSP)	3%	-25.0%
VMware Certified Design Expert (all)	6%	-25.0%
BICSI Technician and Registered Communications Distribution Designer	7%	-22.2%
GIAC Certified Windows Security Administrator	7%	-22.2%
Cisco Certified Network Associate - Data Center	4%	-20.0%
Cisco Certified Network Associate (was CCNA Collaboration)	4%	-20.0%
Cisco Certified Network Associate (was CCNA Wireless)	4%	-20.0%
CWNP/Certified Wireless Analysis Professional (CWAP)	4%	-20.0%
CWNP/Certified Wireless Design Professional (CWDP)	4%	-20.0%
EMC Information Storage Associate (EMCISA)	4%	-20.0%
EMC Storage Administrator - Associate (EMCSA-A)	4%	-20.0%
GIAC Information Security Fundamentals (GISF)	4%	-20.0%
Juniper Networks Certified Internet Associate (JNCIA)	4%	-20.0%
Linux Professional Institute certification (LPIC-Level 2)	4%	-20.0%
Novell Certified Linux Engineer (CLE)	4%	-20.0%
Novell Certified Linux Professional	4%	-20.0%
Novell Identity Manager Administrator	4%	-20.0%
Prince2 Foundation	8%	-20.0%
SAS Certified Data Scientist Using SAS 9	8%	-20.0%
SNIA Certified Storage Architect (SCSA)	4%	-20.0%
SNIA Certified Storage Networking Expert (SCSN-E)	4%	-20.0%
VMware Certified Associate - Cloud	4%	-20.0%
VMware Certified Associate - Data Center Virtualization	4%	-20.0%

**Figure 4**

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## Tech Skills (Non-certified): Pandemic winners

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(Data collected through October 1, 2020)

**Apps Dev. Tools/Platforms**

Agile software development  
Amazon Kinesis  
Amazon Web Services  
Apache Airflow  
Apache Ant  
Apache Camel  
Apache Cloudstack  
Apache Cordova  
Apache Flex  
Apache Hadoop  
Apache Lucene  
Apache Maven  
Apache Pig  
Apache Spark  
Apache Struts/Struts2  
Apache Tomcat  
Apache Zookeeper  
Automated Testing  
AWS CloudFormation  
AWS Lambda  
Behavior-Driven Development  
Bitbucket  
Boost C++  
Business Objects  
C  
C#  
C++  
C++ /CLI  
CA PPM(Clarify PPM)  
Cerner Millennium  
Clojure  
Cloudera software  
Cloud Foundry PaaS  
Cobol  
Cognos  
Confluence  
Cucumber  
Delphi  
Drupal  
Eclipse  
Elixir  
Epic Systems applications  
Erlang  
Ethereum  
F#  
Git/GitHub  
GitLab  
Go language (Golang)

Gosu/Guidewire  
Gradle  
Groovy/Grails  
Grunt  
Hibernate/NHibernate  
HP ALM (App. Lifecycle Mgt)  
HP Unified Functional Testing  
Integration Testing  
iRise  
Jasmine  
Java SE/Java EE  
JBehave  
Jenkins  
JIRA  
JUnit  
Kotlin  
MapReduce  
MATLAB  
Microsoft Azure  
Microsoft SQL Server Mgt Studio  
Microsoft Team Foundation Server  
NetWeaver  
Next.js  
Nim  
NUnit  
Objective-C  
Objective Caml (Ocaml)  
OpenShift  
Oracle APEX  
Oracle Apps Developer Framework  
PL/SQL  
Powerbuilder  
Progress 4GL/Development tools  
R language  
Red Hat Fuse  
Rstudio  
Ruby  
Ruby on Rails  
Saas  
SAS  
Scala  
Scrum  
Selenium  
ServiceNow ITSM  
SPSS  
SQL  
Swift  
Tcl

TestNG  
Transact-SQL/tSQLt  
UML (unified modeling language)  
Visual Basic 6.0  
Visual C++  
VMware Cloud Foundry PaaS  
WebSphereMQ  
Xcode

**SAP & Enterprise Bus. Apps.**

ABAP (all modules)  
Baan  
Enterprise Application Integration (EAI)  
IBM Sterling  
J.D. Edwards /Oracle  
Lawson  
Microsoft Dynamics/Dynamics 365  
NetWeaver  
NetWeaver Portal (SAP EP)  
Oracle BPM  
Oracle CRM  
Oracle E-Business suite  
Oracle Eloqua  
Oracle ERP  
Oracle Financials  
Oracle HFM (Hyperion Fin. Mgt)  
Oracle HRMS  
Oracle NetSuite  
Oracle Payables  
Oracle Payroll  
Oracle Retail  
Oracle SCM  
Oracle SOA Suite  
Pega  
PeopleSoft (CRM/Financials/HCM)  
Remedy  
Salesforce  
Accelerated SAP (SLM)  
SAP AFS  
SAP ALE  
SAP APO  
SAP Auto-ID infrastructure  
SAP Basis Components  
SAP BI Accelerator  
SAP BODI  
SAP Data Services (SAP BODS)  
SAP BOXI (aka Crystal Reports)  
SAP BPC

SAP BSP  
SAP Business One  
SAP Business Workflow/Webflow  
SAP CA  
SAP CAF  
SAP CAR  
SAP CCM  
SAP CE  
SAP CFM  
SAP CO  
SAP CO-PA  
SAP CRM  
SAP Crystal Reports  
SAP CS  
SAP Digital Banking  
SAP EBP  
SAP EDI  
SAP EHS  
SAP EPM  
SAP ERP  
SAP ESA  
SAP Exchange Infrastructure (XI)  
SAP FI (Financial Accounting)  
SAP FI - CA  
SAP FI - FSCM  
SAP FI - Travel Management  
SAP Fiori  
SAP F&R  
SAP FS (Insurance)  
SAP GRC  
SAP GTS  
SAP HANA  
SAP HCM (SAP HR)  
SAP HCM ESS/MSS  
SAP HR-PA  
SAP Hybris  
SAP IBP (Integrated Business Planning)  
SAP IS-U (Utilities)  
SAP ITS  
SAP Leonardo  
SAP LES  
SAP LO  
SAP Lumira  
SAP Manufacturing  
SAP MDG (Master Data Governance)  
SAP MDM  
SAP MDX  
SAP MI

SAP MII  
SAP MM  
SAP MRO  
SAP MRS  
SAP Netweaver Applications Server  
SAP Netweaver BW (BIW)  
SAP NetWeaver Visual Composer  
SAP NWDI  
SAP NWDS  
SAP Oil & Gas  
SAP PI (NetWeaver Process Integ.)  
SAP PLM  
SAP PM  
SAP POSDM  
SAP PP  
SAP PS  
SAP PSCD  
SAP Public Sector Management  
SAP PY (Payroll)  
SAP QM  
SAP for Retail  
SAP Service & Asset Mgt  
SAP S/4HANA  
SAP SCM  
SAP SD  
SAP SD - GTS  
SAP Security  
SAP SEM  
SAP SM  
SAP Smart Forms  
SAP Solution Manager  
SAP SRM  
SAP TM  
SAP UI5 (UI development toolkit for HTML5)  
SAP Web Application Server  
SAP WEBI  
SAP WM  
SAP WM – EWM  
SAP Xcelsius  
Siebel/Siebel Analytics  
Software AG webMethods  
SuccessFactors  
Web Dynpro  
Workday HCM

**Web/e-Commerce Development**

Active Server Pages  
ActiveX  
Adobe Experience Manager  
Ajax  
Amazon Cloudwatch  
AngularJS  
Apache Solr  
Apache web server  
Apache Velocity  
Apache Wicket  
Apex Code  
Backbone.js  
CGI  
Cold Fusion MX  
Content management systems  
CSS/CSS3  
Django  
Docker /Docker Swarm  
Documentum  
Elasticsearch  
Ember.js  
Front End Development  
GatsbyJS  
Google Analytics  
Google App Engine  
Google Cloud Platform  
HTML5  
JavaBeans/EJB 3.0  
JavaFX  
JavaScript  
Java Server Pages  
JBoss/Wildfly  
Jetty  
Joomla!  
jQuery  
JSON  
Julia  
KnockoutJS  
Laravel PHP  
Magento  
Magnolia  
Microsoft .NET  
Microsoft BizTalk Server  
Microsoft Commerce Server  
Microsoft Identity Integration Server  
Microsoft Internet Information Services  
Microsoft Internet Security and Acceleration Server (ISA)  
Microsoft SharePoint/SharePoint Server

Microsoft SharePoint/SharePoint Server  
Microsoft Silverlight  
Microsoft Visual Studio  
Mobile applications development  
Mule/MuleESB  
Node.js  
Oracle Fusion  
Oracle WebLogic/  
Oracle Workflow  
Pandas  
Perl  
PHP (all)  
Python  
React  
Redux  
REST  
RESTful  
SailPoint  
Scalable Vector Graphics (SVG)  
Secure software development  
Sitecore CMS  
SOAP  
Social Media/Networks  
Spring Framework  
Spring Boot  
Spring Cloud  
Spring MVC  
Spring Security  
TIBCO  
UDDI  
Umbraco  
VBScript  
Video/graphics editing  
Visual Interdev  
VoiceXML  
Web collaboration appliances  
Web Content Development  
Web Design  
WebSphere  
WebSphere Datapower  
Wikis  
WSDL  
XAML/XACML  
XHTML MP  
XML (all variants)

**Management, Methodology and Process**

Artificial Intelligence  
Azure Machine Learning  
Big Data Analytics  
Bioinformatics  
Business Analysis  
Business Analytics  
Business intelligence  
Business performance management  
Business process anagement/  
modeling/improvement  
Caffe  
Capacity Planning/Management  
Change management  
COBIT  
Collaboration software  
Complex Event Processing/Event  
Correlation  
Configuration Management  
Continuous Improvement  
Continuous Integration  
CRM  
Cryptography (encryption, VPN)  
Cybersecurity  
Cyber Threat Intelligence  
Data Acquisition and Control Systems  
Data Analytics  
Data Architecture  
Data Cleansing  
Data Engineering  
Data Governance  
Data Integration  
Data Management  
Data Mining  
Data Modelling  
Data Privacy  
Data Quality  
Data Science  
Data Security  
Data Visualization  
DevOps  
DevSecOps  
Digital Analytics  
Digital Forensics  
eDiscovery  
E-Procurement  
ERP  
Flink

Functional Programming  
Game Development  
General Data Protection Regulation (GDPR) Google TensorFlow  
HL7  
Identity and access management  
Incident Management  
Information management  
IT Audit  
IT Governance  
ITIL V3  
Kanban  
Keras  
Machine Learning  
Marketo  
Metadata design and development  
Microservices  
Microsoft SQL Server Analysis Services  
Microsoft Visio  
Natural language processing  
Network Architecture  
Neural Networks  
NIST  
Penetration testing  
Power BI  
Predictive Analytics and Modeling  
Prescriptive Analytics  
Program Management  
Project management/governance  
PyTorch  
QlikView  
Quality Assurance/QA Automation  
Quality management/TQM  
Quantitative Analysis/Regression Analysis  
Razor  
Requirements Engineering/Analysis  
Risk analytics/assessment  
Risk management  
Robotic Process Automation  
Security architecture and models  
Security auditing  
Security management  
Security testing  
SEO  
Service Management  
Six Sigma/Lean Six Sigma  
Social media analysis/analytics  
Software development lifecycle management  
Splunk

Tableau  
Test automation  
Test Driven Development/Scripting  
TIBCO ActiveMatrix BusinessWorks  
TOGAF (Enterprise Architecture)  
Usability Research/Human Factors Research  
User Acceptance Testing  
User Experience/Interface Design  
Vulnerability Scanning/Assessment/Management  
Waterfall  
Web Analytics  
Webtrends analytics  
Zachman Framework

**Messaging & Communications**

ActiveMQ  
Apache Camel  
Apache Kafka  
IBM Domino  
Java Messaging Service  
Message-oriented Middleware (Wave, XMPP/Jabber, etc.)  
Microsoft Exchange  
Novell Groupwise  
Oracle Comm Messaging Server  
RabbitMQ  
TIBCO Enterprise Message Service  
TIBCO Rendezvous  
Unified Communications/Messaging

**Operating Systems**

AIX  
Apache Cloudstack  
CoreOS  
HP-UX  
Linux  
Mac OS X  
Mobile operating systems (iOS, Android)  
OpenStack  
Red Hat Enterprise Linux  
Solaris  
SUSE  
Unix (all)  
VMware vSphere  
Windows 8/10  
Windows NT  
Windows Server 2008/2012

**Systems/Networks**

Active Directory  
 Amazon Elastic Kubernetes Service  
 Ansible  
 Apache Flume  
 Arista  
 ATM  
 Azure Active Directory  
 Business continuity and disaster recovery planning  
 CA Endeavor  
 Chef/Opencode  
 Cisco ASA  
 Cisco CUCM  
 Cisco ICM  
 Cisco IPCC  
 Cisco ISE/Identity Services Engine  
 CiscoNexus  
 Cisco Prime  
 Cisco UCCE  
 Cisco UCCX  
 Citrix Hypervisor (XenServer)  
 Citrix Virtual Apps (XenApp)  
 Cloud architecture  
 Cloud security  
 DHCP  
 EIGRP  
 Ethernet  
 Fast Ethernet  
 Gigabit Ethernet  
 HP ConvergedSystem  
 HP Quality Center  
 HTTPS  
 IaaS (Infrastructure as a Service)  
 Infrastructure architecture  
 Intrusion prevention/detection sys  
 IPX/SPX  
 Juniper  
 Kubernetes  
 LAN  
 Microsoft Application Virtualization  
 Microsoft Hyper-V  
 Microsoft SCCM  
 Microsoft SCVMM  
 Microsoft Virtual Server  
 Mobile device management  
 Mobile security  
 Multiprotocol Label Switching  
 NAS/Network Attached Storage

Network access control/Identity mgmt systems  
 Network security management  
 Novell Netware  
 PaaS  
 Performance Analysis/Tuning  
 Performance Testing  
 Prometheus  
 Puppet  
 Rackspace Cloud  
 RedHat OpenShift  
 Routing (e.g. OSPF)  
 Salt  
 SAN/Storage Area Networks  
 Security skills (project-based)  
 Security Information and Event Management (SIEM)  
 SMTP  
 SNA  
 SolarWinds  
 Storage virtualization/administration  
 TCP/IP  
 Terraform  
 Tivoli  
 Vagrant  
 vCloud  
 Virtualization (various)  
 Virtual security  
 VMware ESXi Server  
 VMware NSX  
 VoIP/IP telephony  
 VPN/OpenVPN  
 WAN/3G/4G services  
 Web Infrastructure  
 Web services security  
 Wireless Network Mgmt  
 Wireless security  
 Wireless sensors/RFID  
 Wireline Networking/Telecomm.  
 WML

**Data/Database**

Amazon Athena  
 Amazon DynamoDB  
 Amazon RedShift  
 Apache Cassandra  
 Apache CouchDB  
 Apache Hive  
 Azure Cosmos DB  
 Azure Data Factory  
 Azure SQL Database  
 Azure Synapse Analytics  
 Base SAS  
 Blockchain  
 Cloudera Impala  
 Couchbase Server  
 Data mining  
 Data security  
 Database management  
 DB2  
 dBASE/xBASE  
 ETL (Extract, transform, load)  
 GIS  
 Hbase  
 Informatica  
 Java Database Connectivity  
 Master data management  
 Microsoft Access  
 Microsoft Exchange Server 2007/2010/2013  
 Microsoft SQL Server Integration Services  
 Microsoft SQL Server 2016/2014/2012/2008  
 MongoDB  
 MySQL  
 NewSQL  
 NoSQL  
 OpenEdge ABL  
 Oracle Application Server  
 Oracle Business Intelligence Enterprise Edition Plus  
 Oracle Coherence  
 Oracle DB 9i/10g/11i/12c  
 Oracle Enterprise Manager  
 Oracle Exadata  
 Oracle Forms  
 Oracle Reports  
 PostgreSQL  
 Redis

Riak  
 Smart Contract  
 Sqoop  
 Sybase Adaptive Server  
 Teradata  
 TIBCO Spotfire  
 Visual SQL

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners

### A. NON-CERTIFIED TECH SKILLS EARNING HIGH PAY---AND STILL GROWING IN VALUE

The following non-certified tech skills meet two prerequisites: they are earned workers *cash pay premiums well above the average* of all 594 skills reported in our **IT Skills and Certifications Pay Index™**, and they *recorded gains in cash market value in the six months ending October 1, 2020*.

No skill below is earning less than the equivalent of 16 percent of base salary—significant considering the average for all skills reported is 9.6 percent of base—and are listed in descending ranked order of cash premium and market value increases (including ties). Not surprising, the list contains a number of security, coding, database, analytics and artificial intelligence related skills.

#### 1. Security architecture and models

*Average Pay Premium:* 19 percent of base salary equivalent

*Market Value Increase:* 5.6 percent (in the six months through October 1, 2020)

Two fundamental concepts in computer and information security are the **security model**, which outlines how security is to be implemented—in other words, providing a “blueprint”—and the **security architecture** of a computer system, which fulfills this blueprint. Security architecture is a view of the overall system architecture from a security point and how the system is put together to satisfy the security requirements. It describes the components of the logical hardware, operating system, and software security components, and how to implement those components to architect, build and evaluate the security of computer systems. With cybersecurity related skills gaining prominence and the threat landscape continuing to be a core business issue, we expect security models and architecting skills to continue to be strong going forward.

#### 2. Apache Zookeeper

*Average Pay Premium:* 18 percent of base salary equivalent

*Market Value Increase:* 20 percent (in the six months through October 1, 2020)

ZooKeeper is an open source Apache project that provides a centralized service for providing configuration information, naming, synchronization and group services over large clusters in distributed systems. The goal is to make these systems easier to manage with improved, more reliable propagation of changes.

If you had a Hadoop cluster spanning 500 or more commodity servers, you would need centralized management of the entire cluster in terms of name, group and synchronization services, configuration management, and more. Other open source projects using Hadoop clusters require cross-cluster services. Embedding ZooKeeper means you don't have to build synchronization services from scratch. Interaction with ZooKeeper occurs by way of Java™ or C interface time.

For applications, ZooKeeper provides an infrastructure for cross-node synchronization by maintaining status type information in memory on ZooKeeper servers. A ZooKeeper server keeps a copy of the state of the entire system and persists this information in local log files. Large Hadoop clusters are supported by multiple ZooKeeper servers, with a master server synchronizing the top-level servers.

Put simply, applications can synchronize their tasks across the distributed cluster by updating their status in a ZooKeeper file that persists in memory on the ZooKeeper servers (called a 'znode'). The znode then informs the rest of the cluster of a specific node's status change. This cluster-wide status centralization service is critical for management and serialization tasks across a large distributed set of servers.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

### 3. HBase

*Average Pay Premium:* 18 percent of base salary equivalent

*Market Value Increase:* 12.5 percent (in the six months through October 1, 2020)

**Apache HBase** is an open source NoSQL database that runs on top of Hadoop Distributed File System (HDFS) and provides real-time read/write access to large datasets. HBase scales linearly to handle huge data sets with billions of rows and millions of columns, and it easily combines data sources that use a wide variety of different structures and schemas. HBase employs a collection of battle-tested technologies from the Hadoop world, and it's a proven winner when building a large, scalable, highly available, distributed database, particularly for those applications where strong consistency is important.

### 4. Marketo

*Average Pay Premium:* 17 percent of base salary equivalent

*Market Value Increase:* 41.7 percent (in the six months through October 1, 2020)

Marketing automation is the process of using software to complete repetitive marketing tasks designed to nurture sales leads, personalize marketing messages and content and, in the process, save marketers' time and effort. Marketing automation is part of a massive stack of marketing technology tools that includes around 8,000 solutions in the marketplace. Marketo is one of the most popular Software-as-a-Service (SaaS)-based marketing automation software solutions owned by Adobe and built to help organizations automate and measure marketing engagement, tasks and workflows. The software aims to allow B2B and B2C marketers target qualified leads, produce lead-to-revenue opportunities and execute automated, personalized marketing campaigns across multiple digital channels and includes SEO and content creation. Marketo supports large enterprises to fast-growing small businesses across a variety of industries from technology to higher education

### 5. Ethereum

*Average Pay Premium:* 17 percent of base salary equivalent

*Market Value Increase:* 30.8 percent (in the six months through October 1, 2020)

Blockchain! **Ethereum** is one of the most popular decentralized open source, public blockchain-based distributed computing platform and OS for smart contract functionality. If you want to become a blockchain expert, learning how to build apps on Ethereum is a great place to start. It is the second-largest cryptocurrency platform by market capitalization, behind Bitcoin, serving as the platform for over 1,900 different cryptocurrencies and tokens, including 47 of the top 100 cryptocurrencies.

### 6. Oracle Coherence

*Average Pay Premium:* 17 percent of base salary equivalent

*Market Value Increase:* 21.4 percent (in the six months through October 1, 2020)

**Oracle Coherence** is a popular Java-based distributed cache and in-memory data grid solution that enables organizations to predictably scale mission-critical applications by providing fast access to frequently used data. As data volumes and customer expectations increase, driven by the "internet of things", social, mobile, cloud and always-connected devices, so does the need to handle more data in real-time, offload over-burdened shared data services and provide availability guarantees. Coherence is intended for systems that require high availability, high scalability and low latency, particularly in cases that traditional relational database management systems provide insufficient throughput, or insufficient performance.



## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

Coherence provides several core services:

- *Reliable messaging and cluster membership services.* Originally built using a combination of UDP multicast and unicast, more recent versions of Coherence introduced non-blocking TCP/IP support.
- *Replicated and partitioned data management and caching services.* At its core Oracle Coherence is a highly scalable and fault-tolerant distributed cache engine, using a specialized scalable protocol and many inexpensive computers to create a cluster which can be seamlessly expanded to add more memory, processing power or both. As a result, it has no single point of failure and transparently fails only if a cluster member fails.
- *Replicated data processing engine* - In addition to caching Coherence provides a rich data processing model so processing can be farmed out to where the data is, and results returned to the client.
- *Event model* allowing developers to interact with data as it changes.
- *Support for clients* written in Java, C++, .NET as well as other languages using REST.

### 7. Apache

*Average Pay Premium:* 17 percent of base salary equivalent

*Market Value Increase:* 13.3 percent (in the six months through October 1, 2020)

**Apache Flink** is an open-source, unified stream-processing and batch-processing framework developed by the Apache Software Foundation. The core of Flink is a distributed streaming data-flow engine written in Java and Scala. Flink executes arbitrary dataflow programs in a data-parallel and pipelined (hence task parallel) manner. Flink's pipelined runtime system enables the execution of bulk/batch and stream processing programs. Furthermore, Flink's runtime supports the execution of iterative algorithms natively.

Flink provides a high-throughput, low-latency streaming engine as well as support for event-time processing and state management. Flink applications are fault-tolerant in the event of machine failure and support exactly-once semantics. Programs can be written in Java, Scala, Python and SQL and are automatically compiled and optimized into dataflow programs that are executed in a cluster or cloud environment.

### 8. [Tie] Natural language processing

#### Master data management

*Average Pay Premium:* 17 percent of base salary equivalent

*Market Value Increase:* 6.3 percent (in the six months through October 1, 2020)

Human language doesn't speak in zeros and ones, but there's a lot of benefit and productivity that can be gained when machines are taught to read, decipher, understand, and make sense of the human language in a manner that is valuable. That's the goal of **natural language processing**, usually shortened as NLP. Early efforts at this include pieces of digital assistants like Alexa, Microsoft Cortana, Google Assistant, and Siri. It's the driving force behind such common applications as Google Translate, the grammatical checking in Microsoft Word, and Interactive Voice Response (IVR) applications used in call centers. NLP is also essential when it comes to working with many types of unstructured data such as the data in electronic health records, emails, text messages, transcripts, social media posts -- anything with a language component. It's through NLP that we can get to more advanced technologies such as sentiment analysis.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

NLP involves applying algorithms to identify and extract the natural language rules such that the unstructured language data is converted into a form that computers can understand. When the text has been provided, computers utilize algorithms to extract meaning associated with every sentence and collect the essential data from them. Many different classes of machine-learning algorithms have been applied to natural-language-processing tasks. These algorithms take as input a large set of "features" that are generated from the input data. Thus, NLP has evolved into research focused on statistical models which make soft, probabilistic decisions based on attaching real-valued weights to each input feature. These models have the advantage that they can express the relative certainty of many different possible answers rather than only one, producing more reliable results when such a model is included as a component of a larger system.

Systems based on machine-learning algorithms have many advantages and they all are driving NLP forward as a hot skill area to invest in. Consider the following.

- Learning procedures used during machine learning automatically focus on the most common cases, whereas when writing rules by hand it is often not at all obvious where the effort should be directed.
- Automatic learning procedures can make use of statistical inference algorithms to produce models that are robust to unfamiliar input (e.g. containing words or structures that have not been seen before) and to erroneous input (e.g. with misspelled words or words accidentally omitted). NLP's advantage is that creating systems of handwritten rules that make soft decisions is extremely difficult, error-prone and time-consuming.
- Systems based on automatically learning the rules can be made more accurate simply by supplying more input data. There is a limit to the complexity of systems based on handcrafted rules, beyond which the systems become more and more unmanageable. But creating more data to input to machine-learning systems simply requires a corresponding increase in the number of man-hours worked, generally without significant increases in the complexity of the annotation process.

**Master data management (MDM)** arose out of the necessity for businesses to improve the consistency and quality of their key data assets, such as product data, asset data, customer data, location data, etc. Many businesses today, especially global enterprises, have hundreds of separate applications and systems where data that crosses organizational departments or divisions can easily become fragmented, duplicated and most commonly out of date. When this occurs, accurately answering even the most basic but critical questions about any type of performance metric or KPI for a business becomes hard. The basic need for accurate, timely information is acute and as sources of data increase, managing it consistently and keeping data definitions up to date so all parts of a business use the same information is a never-ending challenge. That's what has and will continue to drive a premium on MDM skills.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

### 10. Keras

*Average Pay Premium:* 16 percent of base salary equivalent

*Market Value Increase:* 23.1 percent (in the three months through October 1, 2020)

**Keras** is a high-level deep learning API written in Python, running on top of the machine learning platform TensorFlow. It was developed with a focus on enabling fast experimentation: being able to go from idea to result as fast as possible. TensorFlow 2.0 is an end-to-end, open-source machine learning platform. You can think of it as an infrastructure layer for differentiable programming, combining four key abilities:

- Efficiently executing low-level tensor operations on CPU, GPU, or TPU.
- Computing the gradient of arbitrary differentiable expressions.
- Scaling computation to many devices
- Exporting programs ("graphs") to external runtimes such as servers, browsers, mobile and embedded devices.

Keras is an approachable, highly-productive interface for solving machine learning problems, with a focus on modern deep learning. It provides essential abstractions and building blocks for developing and shipping machine learning solutions with high iteration velocity. It contains numerous implementations of commonly used neural-network building blocks such as layers, objectives, activation functions, optimizers, and a host of tools to make working with image and text data easier to simplify the coding necessary for writing deep neural network code. The code is hosted on GitHub, and community support forums include the GitHub issues page, and a Slack channel.

In addition to standard neural networks, Keras has support for convolutional and recurrent neural networks. It supports other common utility layers like dropout, batch normalization, and pooling. Keras allows users to productize deep models on smartphones (iOS and Android), on the web, or on the Java Virtual Machine. It also allows use of distributed training of deep-learning models on clusters of Graphics processing units (GPU) and tensor processing units (TPU).

### 11. [Tie] Apache Cloudstack

Cloud Foundry

Cloudera Impala

Erlang

Six Sigma/Lean Six Sigma

*Average Pay Premium:* 16 percent of base salary equivalent

*Market Value Increase:* 14.3 percent (in the six months through October 1, 2020)

**Apache CloudStack** is open source software designed to deploy and manage large networks of virtual machines, as a highly available, highly scalable Infrastructure as a Service (IaaS) cloud computing platform. CloudStack is used by a number of service providers to offer public cloud services, and by many companies to provide an on-premises (private) cloud offering, or as part of a hybrid cloud solution.

CloudStack is a turnkey solution that includes the entire "stack" of features most organizations want with an IaaS cloud: compute orchestration, Network-as-a-Service, user and account management, a full and open native API, resource accounting, and a first-class User Interface (UI).

CloudStack currently supports the most popular hypervisors: VMware, KVM, Citrix eServer, Xen Cloud Platform (XCP), Oracle VM server and Microsoft Hyper-V.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

Users can manage their cloud with an easy to use Web interface, command line tools, and/or a full-featured RESTful API. In addition, CloudStack provides an API that's compatible with AWS EC2 and S3 for organizations that wish to deploy hybrid clouds.

**Cloud Foundry** is an open source, multi-cloud application platform as a service (PaaS). Unlike most other cloud computing platform services — which are tied to particular cloud providers — Cloud Foundry is a container-based architecture running apps in any programming language over a variety of cloud service providers. If desired, you can deploy it on AWS, but you can also host it yourself on your own OpenStack server, or through HP Helion or VMware vSphere. Cloud Foundry is promoted for continuous delivery as it supports the full application development lifecycle, from initial development through all testing stages to deployment. Its architecture runs apps in any programming language over a variety of cloud service providers, allowing developers to use the cloud platform that suits specific application workloads and move those workloads as necessary within minutes with no changes to the application.

Cloud Foundry is optimized to deliver fast application development and deployment; highly scalable and available architecture; DevOps-friendly workflows; a reduced chance of human error; Multi-tenant compute efficiencies. Key benefits of Cloud Foundry that power its popularity include:

- Application portability.
- Application auto-scaling.
- Centralized platform administration.
- Centralized logging.
- Dynamic routing.
- Application health management.
- Integration with external logging components like Elasticsearch and Logstash.
- Role-based access for deployed applications.
- Provision for vertical and horizontal scaling.
- Infrastructure security.
- Support for various IaaS providers

**Cloudera Impala** is an open source Massively Parallel Processing (MPP) query engine that provides high-performance, low-latency SQL queries on data stored in popular Apache Hadoop file formats. The fast response for queries enables interactive exploration and fine-tuning of analytic queries rather than long batch jobs traditionally associated with SQL-on-Hadoop technologies, meaning that data can be stored, shared, and accessed using various solutions that avoids data silos and minimizes expensive data movement. Impala returns results typically within seconds or a few minutes, rather than the many minutes or hours that are often required for Hive queries to complete. We cannot understate the value of this to advanced data analytics platforms and the work of data scientists and analysts engaged in Big Data initiatives and the impact this has on skills acquisition demand going forward.

**Erlang** is a general-purpose, concurrent, functional programming language and a garbage-collected runtime system used to build massively scalable soft real-time systems with requirements on high availability. Some of its uses are in telecoms, banking, e-commerce, computer telephony and instant messaging. Erlang's runtime systems have built-in support for concurrency, distribution and fault tolerance. The term Erlang is used interchangeably with Erlang/OTP, or Open Telecom Platform (OTP), which consists of the Erlang runtime system, several ready-to-use components (OTP) mainly written in Erlang, and a set of design principles for Erlang programs.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

The Erlang runtime system is designed for systems with these traits:

- Distributed
- Fault-tolerant
- Soft real-time
- Highly available, non-stop applications
- Hot swapping, where code can be changed without stopping a system.

The Erlang programming language has immutable data, pattern matching, and functional programming. The sequential subset of the Erlang language supports eager evaluation, single assignment, and dynamic typing.

**Six Sigma** is a method that provides organizations tools to improve the capability of their business processes. The increase in performance and decrease in process variation helps lead to defect reduction and improvement in profits, employee morale, and quality of products or services. Six Sigma focuses on reducing process variation and enhancing process control, whereas **lean** drives out waste (non-value-added processes and procedures) and promotes work standardization and flow. The distinction between Six Sigma and lean has blurred, with the term "lean Six Sigma" being used more and more often because process improvement requires aspects of both approaches to attain positive results.

**Lean Six Sigma** is a fact-based, data-driven philosophy of improvement that values defect prevention over defect detection. It drives customer satisfaction and bottom-line results by reducing variation, waste, and cycle time, while promoting the use of work standardization and flow, thereby creating a competitive advantage. It applies anywhere variation and waste exist, and every employee should be involved.

Lean and Six Sigma both provide customers with the best possible quality, cost, delivery, and a newer attribute, nimbleness. There is a great deal of overlap between the two disciplines; however, they both approach their common purpose from slightly different angles:

- Lean focuses on waste reduction, whereas Six Sigma emphasizes variation reduction.
- Lean achieves its goals by using less technical tools such as kaizen, workplace organization, and visual controls, whereas Six Sigma tends to use statistical data analysis, design of experiments, and hypothesis testing

Often successful implementations begin with the lean approach, making the workplace as efficient and effective as possible, reducing waste, and using value stream maps to improve understanding and throughput. If process problems remain, more technical Six Sigma statistical tools may then be applied.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

### 16. [Tie] Elixir

#### Functional Programming

*Average Pay Premium:* 16 percent of base salary equivalent

*Market Value Increase:* 6.7 percent (in the six months through October 1, 2020)

**Elixir** is a dynamic, functional, concurrent general-purpose programming language that runs on the BEAM virtual machine used to implement the Erlang programming language. Elixir builds on top of Erlang and shares the same abstractions for building distributed, fault-tolerant scalable and maintainable applications while also being successfully used in web development, embedded software, data ingestion, and multimedia processing domains. Elixir also provides productive tooling and an extensible design. The latter is supported by compile-time metaprogramming with macros and polymorphism via protocols

Platform features of Elixir:

- *Scalability.* All Elixir code runs inside lightweight threads of execution (called processes) that are isolated and exchange information via messages. Due to their lightweight nature, it is not uncommon to have hundreds of thousands of processes running concurrently in the same machine. Isolation allows processes to be garbage collected independently, reducing system-wide pauses, and using all machine resources as efficiently as possible (vertical scaling). Processes are also able to communicate with other processes running on different machines in the same network. This provides the foundation for distribution, allowing developers to coordinate work across multiple nodes (horizontal scaling).
- *Fault-tolerance.* The unavoidable truth about software running in production is that things will go wrong. Even more when we take network, file systems, and other third-party resources into account. To cope with failures, Elixir provides supervisors which describe how to restart parts of your system when things go awry, going back to a known initial state that is guaranteed to work.

Language features of Elixir:

- *Functional programming.* Functional programming promotes a coding style that helps developers write code that is short, concise, and maintainable. For example, pattern matching allows developers to easily destructure data and access its contents. When mixed with guards, pattern matching allows us to elegantly match and assert specific conditions for some code to execute. Elixir relies heavily on those features to ensure your software is working under the expected constraints.
- *Extensibility and DSLs.* Elixir has been designed to be extensible, letting developers naturally extend the language to particular domains, in order to increase their productivity.

Tooling features of Elixir:

- *A growing ecosystem.* Elixir ships with a great set of tools to ease development. Mix is a build tool that allows you to easily create projects, manage tasks, run tests, manage dependencies, and integrates with the Hex package manager, which performs dependency resolution, fetches remote packages, and hosts documentation for the whole ecosystem.
- *Interactive development.* Tools like IEx (Elixir's interactive shell) are able to leverage many aspects of the language and platform to provide auto-complete, debugging tools, code reloading, as well as nicely formatted documentation.

## NON-CERTIFIED IT SKILLS ANALYSIS – Pandemic Winners, cont'd.

- *Erlang compatible*. Elixir runs on the Erlang VM giving developers complete access to Erlang's ecosystem, used by companies like Heroku, WhatsApp, Klarna and many more to build distributed, fault-tolerant applications. An Elixir programmer can invoke any Erlang function with no runtime cost.

**Functional programming** has become a really hot topic in the JavaScript world. Just a few years ago, few JavaScript programmers even knew what functional programming is, but every large application codebase I've seen in the past 3 years makes heavy use of functional programming ideas. Often abbreviated FP, functional programming is the process of building software by composing pure functions, avoiding shared state, mutable data, and side-effects. Functional programming is declarative rather than imperative, and application state flows through pure functions. Contrast with object oriented programming, where application state is usually shared and collocated with methods in objects.

Functional programming is a programming paradigm, meaning that it is a way of thinking about software construction based on some fundamental, defining principles (listed above). Other examples of programming paradigms include object oriented programming and procedural programming.

Functional code tends to be more concise, more predictable, and easier to test than imperative or object oriented code — but if you're unfamiliar with it and the common patterns associated with it, functional code can also seem a lot denser, and the related literature can be impenetrable to newcomers.

## Q4 2020 Data Trend Charts

### 2020 IT Skills & Certifications Volatility Index™

(Data collected through July 1, 2020)

Demand dynamics in benchmarked certified and non-certified IT skills pay



## TRENDS HIGHLIGHTS

### 2020 IT Skills & Certifications Volatility Index™

Volatility in market value for individual IT skills and certifications—defined as incidence of gains or declines over a period of time in premium pay earned by IT professionals for specific technical and business skills—increased from July 1, 2020 to October 1, 2020 according to the latest update of Foote Partners' long-running *IT Skills and Certifications Pay Index™* of market values for tech skills. Market value is measured by tracking additional cash compensation paid to workers by their employers for specific certified and non-certified skills they possess.

#### Current Quarterly Recap (data collected through October 1, 2020)

##### TOTAL: All Skills and Certifications

- **24.2%** of skills and certifications (266 of 1,101) changed in market value in 3rd Quarter 2020 compared to **28%** in the prior quarter, **29%** in the first quarter, **21%** in the last quarter of 2019 and **17.4%** in the third quarter of 2019.
- **118** gained value and **148** declined in value

##### CERTIFIED SKILLS

- **15.7%** of reported certifications (80 of 508) changed market value in 3rd Quarter 2020, six points lower than the **22%** in the prior quarter, a whopping twelve points lower than the **28.2%** volatility in the 1<sup>st</sup> Quarter, and nearly equal to the **15.5%** volatility in the last quarter of 2019.
- **20** certifications gained market value; **60** declined in value

##### NON-CERTIFIED SKILLS

- **31.4%** of reported skills (186 of 593) changed value in 3rd Quarter 2020, two points lower than the **33.5%** in the prior quarter, two points higher than **29.6%** in the 1<sup>st</sup> Quarter, and well above **26% volatility** in the third and fourth quarters of 2019.
- **98** noncertified skills gained in market value; **88** declined in value

Tracking skills volatility is useful in many ways: analyzing and forecasting demand for skills; monitoring IT workforce transition; and understanding IT management decision making. In fact, we believe statistical volatility in IT skills pay offers a more complete story of true labor market conditions than salary movements and hiring behavior, among other common indicators. Important in this distinction is that skills can be segmented and benchmarked more meaningfully than jobs allowing to microanalyses.

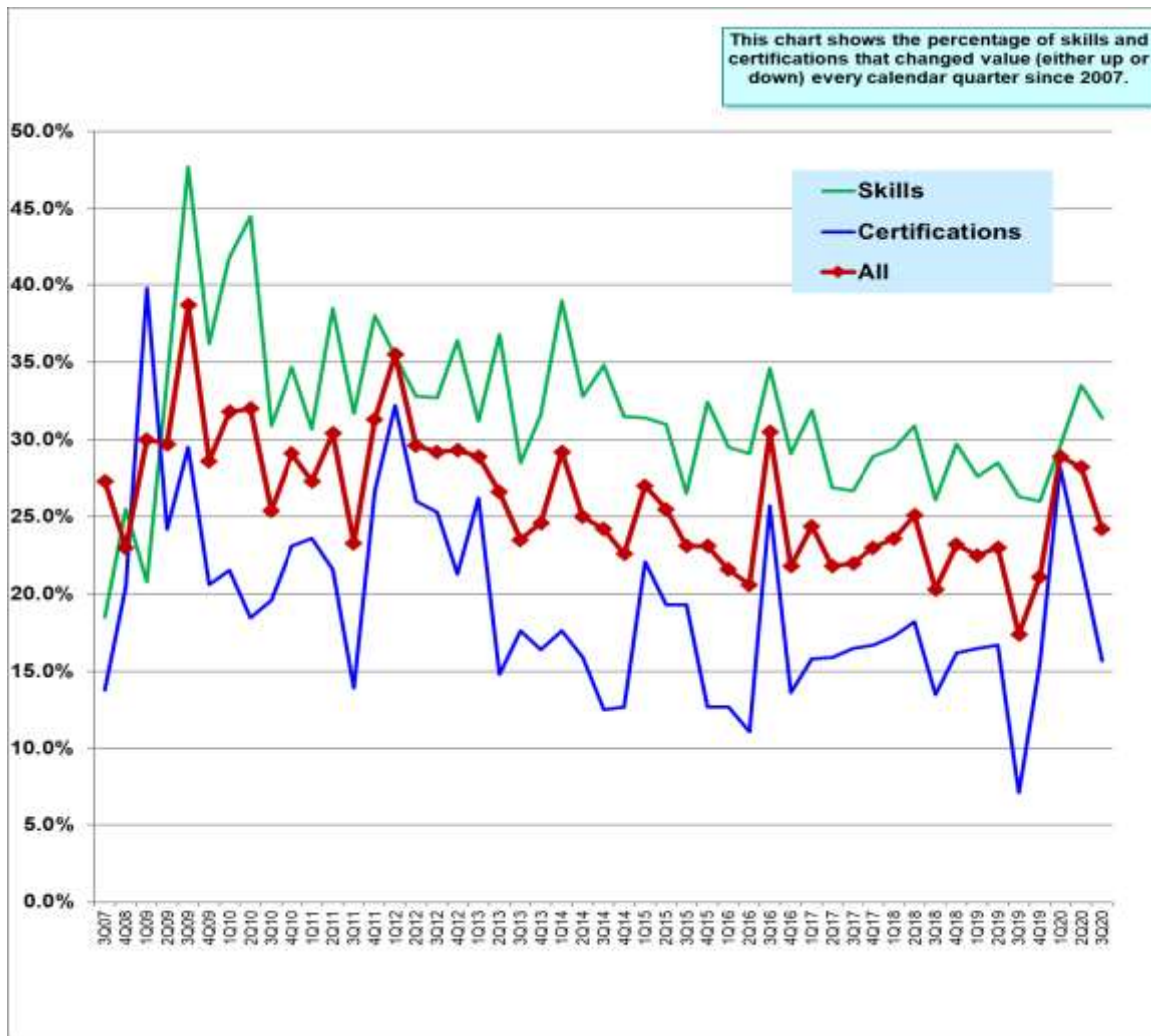
Similar to jobs, IT skills have broad skills categories that can be tracked (e.g., security, networking, systems, database, applications development). But unlike jobs, skills pay can be pinpointed to hundreds of niches and specialization. Also, unlike most job trends analyses, within skills categories and niches are *vendor-specific* and *vendor independent* skill specializations for more granular tracking, analysis, and forecasting.

Skills and certifications volatility prior to 2008 averaged in the 14% - 19% range. Quarterly volatility in the last two years has been in the 20% to 31% range. This is an important shift that we believe signals a move that employers are taking a more long-term view to building their tech workforces for emerging technologies such as Blockchain, AI/Machine learning, and a variety of digital solutions. Tech leaders right now are demanding more agility, faster reaction times, and more predictable execution; this is keeping volatility high as skills markets constantly adjust to meet surges in demand for specific certified and non-certified skills.

They will be able to achieve those capabilities through applying architecture principles and practices to people management.  
**We discuss this in greater detail earlier in this report.**

**VOLATILITY HIGHLIGHTS - 15 Year Trending**

**IT Skills and Certifications Volatility Index™ – 1,110 Skills and Certifications**



**Recent IT skills and certifications volatility trends**

**QUARTERLY SUMMARY**

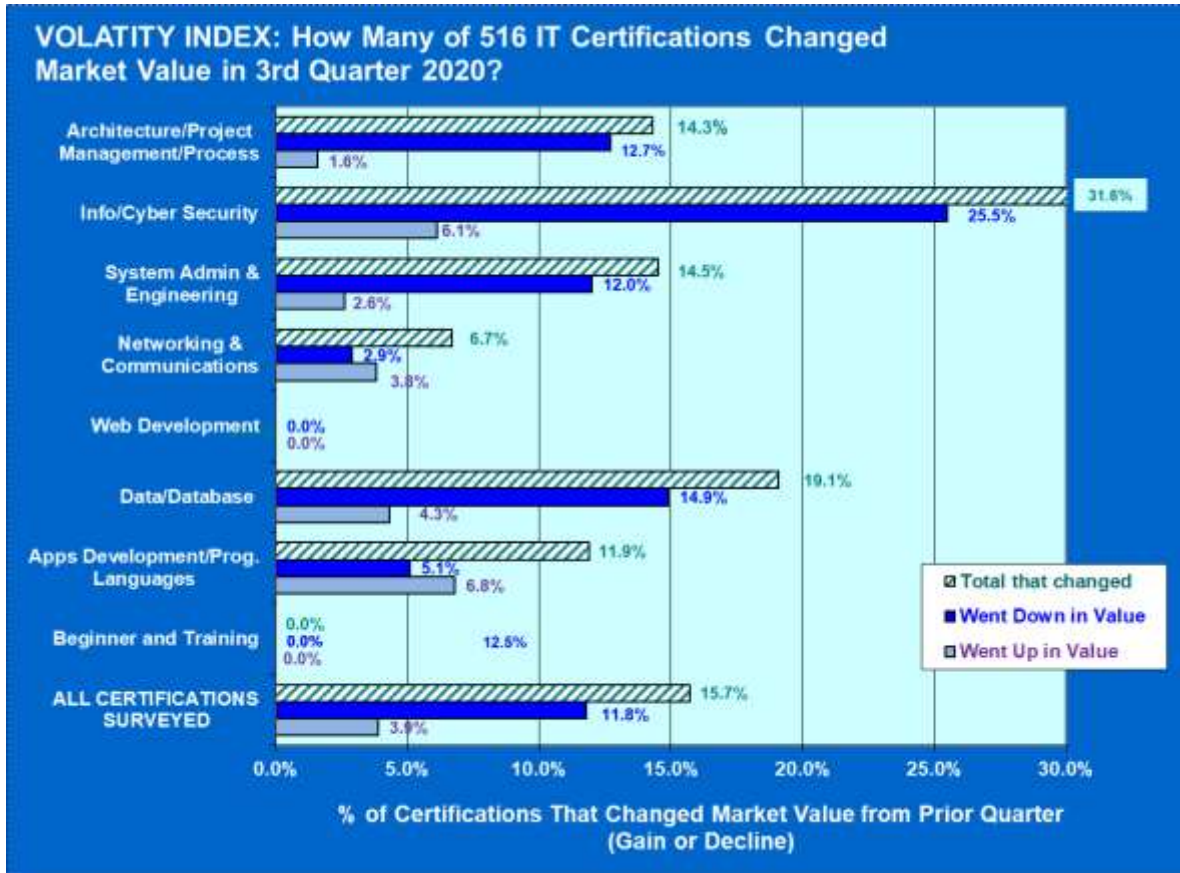
3<sup>rd</sup> quarter 2020 volatility in skills and certifications values measured 24%, slightly below the one-year average (25.6%) for all 1,110 certified and noncertified skills reported by Foote Partners but narrowly higher than the 23.6% average over the past two years.

**NONCERTIFIED SKILLS VOLATILITY** in 3Q 2020 (31.4%) was two points lower than the prior quarter (33.5%) but two points higher than the average volatility over the past 2 years (29.1%)

**IT CERTIFICATIONS VOLATILITY** in 3Q 2020 receded to 15.7%, significantly lower than 22% in the prior quarter and 28.2% volatility in the first three months of 2020. But it was equal to volatility in the final quarter of 2019.

(Pay data supporting these charts available in the [IT Skills and Certifications Pay Index™](#) – 2007 to 2020 quarterly data edition)

**VOLATILITY HIGHLIGHTS** IT Certifications – 3rd Quarter 2020 data



(Source: Foote Partners LLC, [2020 IT Skills & Certifications Pay Index™](#))

**IT Skills and Certifications Volatility Index™**  
**3Q 2020 data edition findings: Tech Certifications**

**IT Certifications Volatility Highlights**

Among 516 certifications surveyed, highest volatility ( $\geq 15\%$ ) occurred in these segments (ranked highest to lowest):

- Info/Cybersecurity
- Data/Database

Within segments, notable upward volatility (value gains) occurred most in these:

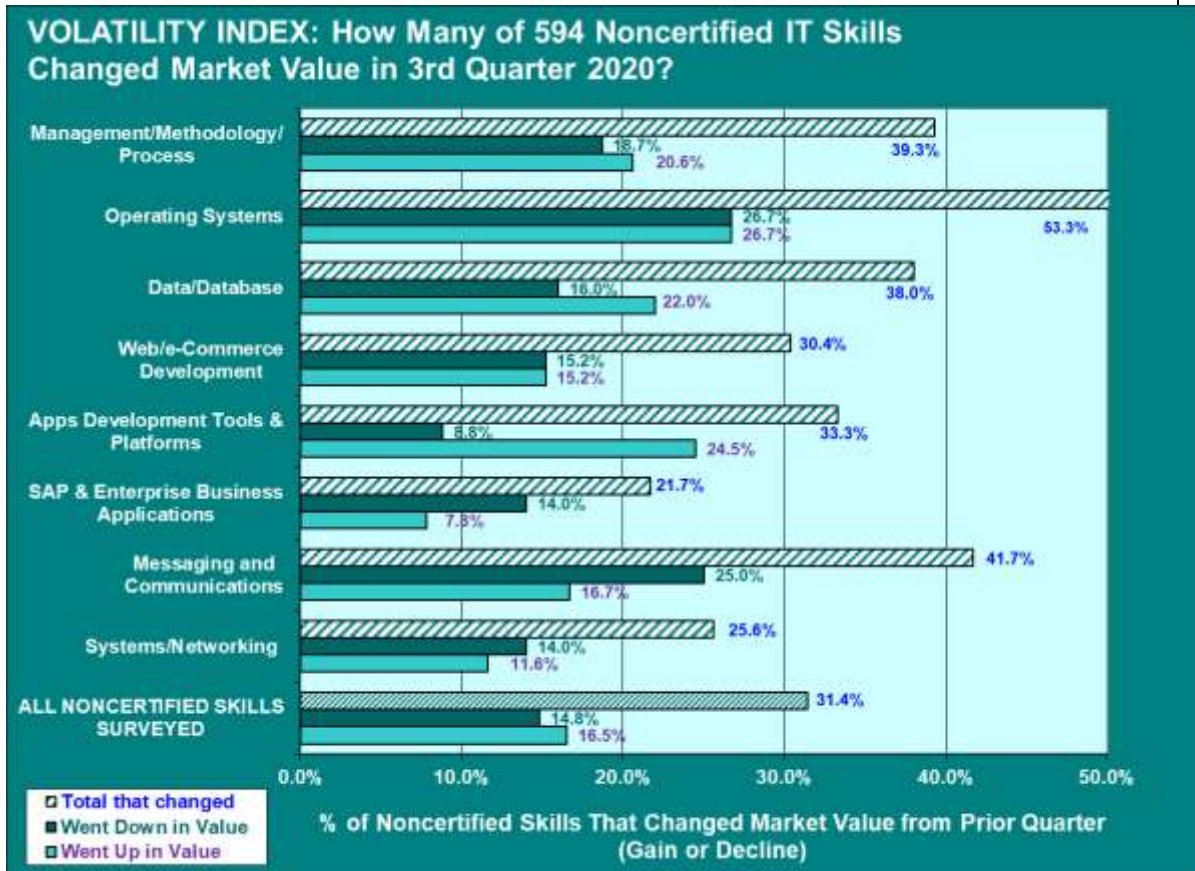
- No certification category exceeded 7% quarterly growth. Most growth occurred in Applications Development and Info/Cybersecurity segments.

Within segments, notable downward volatility (value declines) occurred most in these (ranked):

- Info/Cybersecurity
- Data/Database
- Systems Administration & Engineering
- Architecture/Project Mgt/Process

(Pay data supporting these charts available in the [IT Skills and Certifications Pay Index™](#) – 2007 to 2020 quarterly data edition)

**VOLATILITY HIGHLIGHTS** Non-certified IT Skills – 3rd Quarter 2020 data



(Source: Foote Partners LLC, [2020 IT Skills & Certifications Pay Index™](#))

**IT Skills and Certifications Volatility Index™**  
3Q 2020 data edition findings: Non-certified IT Skills

**Noncertified IT Skill Pay Volatility Highlights**

Among 594 noncertified IT skills surveyed, high volatility (>20%) occurred in these segments (ranked highest to lowest):

- Operating Systems
- Messaging and Communications
- Management/Methodology/Process
- Data/Database
- Applications Development Tools & Platforms
- Web/E-commerce Development
- Systems/Networking
- SAP & Enterprise Business Apps

Within segments, notable upward volatility (value **gains**) occurred most in these (ranked):

- Operating Systems
- Applications Development Tools & Platforms
- Data/Database
- Management/Methodology/Process

Within segments, notable downward volatility (value **declines**) occurred most in these (ranked):

- Operating Systems
- Messaging and Communications

(Pay data supporting these charts available in the [IT Skills and Certifications Pay Index™](#) – 2007 to 2020 quarterly data edition)

## 2020 IT Skills and Certifications Pay Index™ (3<sup>rd</sup> Quarter Data edition)

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- Pay premiums for **1,110 certified and noncertified IT skills**
  - Three data points for each position: 10<sup>th</sup>, 50<sup>th</sup>, 90<sup>th</sup> percentile
- Verified and validated IT skills pay data from **81,032 IT professionals at 3,640 employers** in US and Canada
- Current data collected through October 1, 2020 (updated quarterly)
- Excel format data tables. Master agreements for data loading in place with MarketPay, CompAnalyst, WillisTowersWatson.
- Certifications Guide containing basic information about surveyed IT certifications (pre-requisites; costs; test content; lab requirements, etc.)

**Pricing:** \$5,800 single edition. \$19,800 annual subscription

### Definition of IT skills premium pay

- Pay that IT workers receive for possessing high-value IT and business skills used on the job
- Given in the form of a bonus, or embedded in base salary to adjust for the presence of a dominant vendor or technology central to job performance (examples: Cisco Network Engineer, Python Software Engineer, Redhat Linux Systems Administrator, or SAP Developer.)
- Often used to adjust either base pay or total pay in situations where job title does not match actual on-the-job duties and responsibilities, and changing the job title is not an attractive option
- May be used as a reward, recruiting inducement, retention tool, or as a guide for creating consulting rate cards

## ABOUT THIS RESEARCH

Foote Partners' primary research survey for tracking IT skills and certifications pay and supply/demand volatility is the industry-leading ***IT Skills and Certifications Pay Index™ (ITSCPI)***, launched in 1999 and updated every three months since that time. Data covering 330,340 tech professionals at 3,640 employers in 83 U.S. and Canada cities are reported for IT salaries and skills pay earned for 250 positions and 1,110 certified and noncertified technical and business skills. Verified and validated pay data for 81,032 tech workers has been included in the 3<sup>rd</sup> Quarter 2020 data edition of the ITSCPI, compiled from data collected through October 1, 2020.

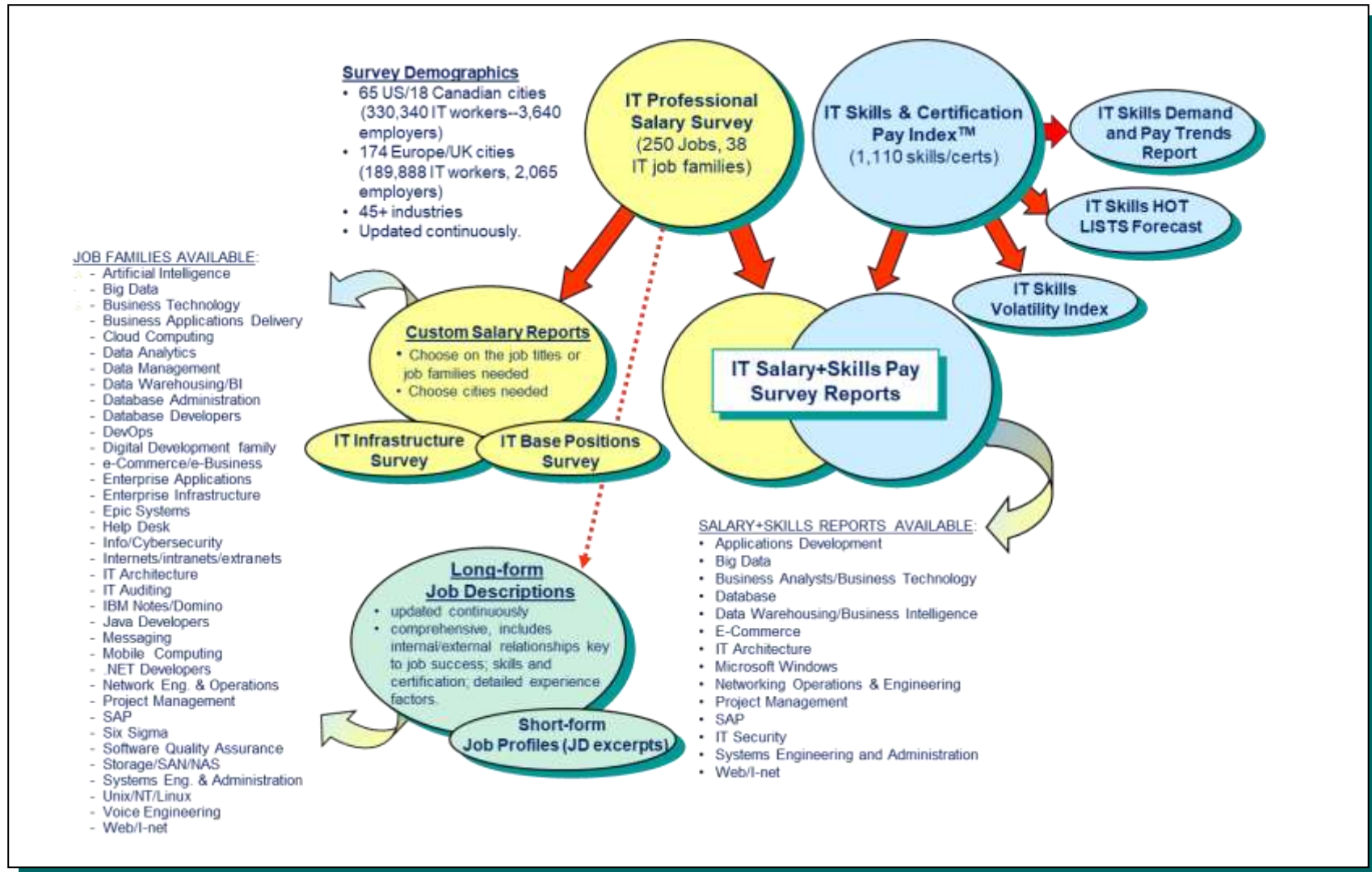
Demographics of the participating organizations for our latest update are as follows, measured most appropriately for the type of business, by revenues, assets, total premiums and operating budgets:

- 18% of participating organizations have \$5 billion+ in sales/\$15+ billion in total assets
- 28% of participating organizations earn more than \$1 billion in annual revenues or more than \$5 billion in total assets
- 46% of participating organizations have \$500+ million in sales/\$1+ billion in total assets/\$500+ million in premiums/\$500+ million operating budget (government, educational, not-for-profit)
- 54% of participating organizations fall in the SMB (small-to-medium sized business) segment, generally defined as organization under \$500 million in sales.
- [Public sector] 5% have operating budgets of \$500 million or more, [nonprofit/educational sectors] 4% with operating budgets \$100 million to less than \$500 million

### TO OBTAIN A COPY OF THE LATEST ***IT SKILLS AND CERTIFICATIONS PAY INDEX™***

Please visit the Foote Partners web site: [IT Skills and Certifications Pay Index](#)

**Foote Partners 3Q 2020 Tech Compensation Survey Product Map**



## **ABOUT FOOTE PARTNERS**

Foote Partners, LLC is a technology analyst firm and independent benchmark research organization focusing on the people (versus vendor) side of managing technology and technology value creation. A thought leader and trusted advisor to thousands of employers on five continents who purchase our products and services, our company provides pragmatic benchmark research and forward-thinking advice and market intelligence targeting the tech workforce in the modern highly integrated business/IT hybrid environment in which all private and public organizations now operate.

Our products are deeply grounded in specialized proprietary data-driven statistical and empirical research, benchmark surveys, and business intelligence collected from thousands of North American employers with whom we have deep longstanding research partnerships. These partnerships have been created and supported specifically to enable unique market intelligence views and difficult-to-find decision support research on the multiple facets of IT human capital management. As a group, these U.S., Canadian, and European partners were selected to meet strict criteria for what we believe is the most meaningful demographic representation for tech professionals in each local labor markets.

Founded in 1997 and comprised of former Gartner industry analysts, McKinsey & Company, Mercer and WillisTowersWatson senior consultants, and former corporate HR, IT, and business executives, the firm's research division publishes 70+ quarterly-updated benchmarking, analytical research and forecasting products that help employers benchmark their IT compensation, solve difficult information technology management and workforce problems, and strengthen their ability to execute complex business solutions.

Foote Partners tech compensation survey findings and labor market trend analyses are featured regularly in countless business, HR, and IT media sources and periodicals around the globe, including *Bloomberg BusinessWeek*, *Forbes*, *Fortune*, *Wall Street Journal*, *New York Times*, *CIO Magazine*, *ComputerWorld*, and *WorldatWork's Journal* and *Workspan Magazine*; and in appearances on network and cable television, National Public Radio, and countless podcasts and webcasts.

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